



GRANT AGREEMENT FOR MEMBERS¹

NUMBER 874477 — PJ02-W2 AART

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

the **Single European Sky ATM Research Joint Undertaking** ('the JU'), represented for the purposes of signature of this Agreement by the JU Executive Director or his/her representative, Florian GUILLERMET,

and

on the other part,

1. 'the coordinator':

EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION (EUROCONTROL), established in Rue de la Fusée 96, BRUXELLES 1130, Belgium, VAT number: not applicable, as 'beneficiary not receiving JU funding' (see Article 9), represented for the purposes of signing the Agreement by Eamonn BRENNAN

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

2. **AIRBUS (AIRBUS SAS)**, established in 2 ROND POINT EMILE DEWOITINE, BLAGNAC 31700, France, VAT number: FR89383474814,

3. **POLSKA AGENCJA ZEGLUGI POWIETRZNEJ (PANSA (B4))**, established in UL. WIEZOWA 8, WARSZAWA 02 147, Poland, VAT number: PL5222838321,

4. **LUFTFARTSVERKET (LFV/COOPANS)**, established in HOSPITALSGATAN 30, NORRKOPING 602 27, Sweden, VAT number: SE202100079501,

5. **DASSAULT AVIATION (DASSAULT)**, established in 9 ROND POINT CHAMPS-ELYSEES-MARCEL DASSAULT, PARIS 75008, France, VAT number: FR73712042456,

6. **DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS)**, established in AM DFS CAMPUS 10, LANGEN 63225, Germany, VAT number: DE114110232,

7. **ENAIRE (ENAIRE)**, established in AVENIDA DE ARAGON S/N BLOQUE 330, PORTAL 2 PARQUE EMPRESARIAL LAS MERCEDES, MADRID 28022, Spain, VAT number: ESQ2822001J,

¹ 'Members' means "members of the Joint Undertaking" as defined under Article 1(2) and 1(3) of the Statutes of the JU, Annex to the SESAR Regulation.



8. **ENAV SPA (ENAV)**, established in VIA SALARIA 716, ROMA 00138, Italy, VAT number: IT02152021008,
9. **HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG (HC (FSP))**, established in IGLO UTCA 33 35, BUDAPEST 1185, Hungary, VAT number: HU13851325,
10. **HONEYWELL AEROSPACE (Honeywell SAS)**, established in 4 AVENUE SAINT GRANIER, TOULOUSE 31300, France, VAT number: FR92340797919,
11. **INDRA SISTEMAS SA (INDRA)**, established in AVENIDA DE BRUSELAS 35, ALCOBENDAS MADRID 28108, Spain, VAT number: ESA28599033,
12. **LEONARDO - SOCIETA PER AZIONI (LDO)**, established in PIAZZA MONTE GRAPPA 4, ROMA 00195, Italy, VAT number: IT00881841001,
13. **SINTEF AS (SINTEF (NATMIG))**, established in STRINDVEGEN 4, TRONDHEIM 7034, Norway, VAT number: NO919303808MVA,
14. **NATS (EN ROUTE) PUBLIC LIMITED COMPANY (NATS)**, established in 4000 PARKWAY WHITELEY, FAREHAM PO15 7FL, United Kingdom, VAT number: GB440379456,
15. **AVINOR AS (Avinor-SEAC2020)**, established in DRONNING EUFEMIAS GATE 6, OSLO 2061, Norway,
16. **HEATHROW AIRPORT LIMITED (HAL (SEAC2020))**, established in NELSON ROAD THE COMPASS CENTRE HOUNSLOW, LONDON TW6 2GW, United Kingdom, VAT number: GB927365404,
17. **SWEDAVIA AB (Swed (SEAC2020))**, established in SWEDAVIA, STOCKHOLM ARLANDA 190 45, Sweden, VAT number: SE556797081801,
18. **THALES LAS FRANCE SAS (THALES AIR SYS)**, established in AVENUE GAY LUSSAC 2, ELANCOURT 78990, France, VAT number: FR15319159877,
19. **THALES AVS FRANCE SAS (THALES AVS)**, established in 75-77 AVENUE MARCEL DASSAULT, MERIGNAC 33700, France, VAT number: FR65612039495,
20. **RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4))**, established in JENEC NAVIGACNI 787, JENEC 252 61, Czechia, VAT number: CZ699004742, as ‘beneficiary not receiving JU funding’ (see Article 9),
21. **LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK (LPS SR (B4))**, established in IVANSKA CESTA 93, BRATISLAVA 823 07, Slovakia, VAT number: SK2020244699, as ‘beneficiary not receiving JU funding’ (see Article 9),
22. **VALSTYBES IMONE ORO NAVIGACIJA (ON (B4))**, established in RODUNIOS KEL 2, VILNIAUS 02188, Lithuania, VAT number: LT100604610, as ‘beneficiary not receiving JU funding’ (see Article 9),



23. **AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH (ACG/COOPANS)**, established in WAGRAME STRASSE 19, WIEN 1220, Austria, VAT number: ATU37259408, as ‘beneficiary not receiving JU funding’ (see Article 9),

24. **CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD (CCL/COOPANS)**, established in RUDOLFA FIZIRA 2, VELIKA GORICA 10410, Croatia, VAT number: HR33052761319, as ‘beneficiary not receiving JU funding’ (see Article 9),

25. **UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY (IAA/COOPANS)**, established in D'OLIER STREET 11-12 THE TIMES BUILDING, DUBLIN D02 T449, Ireland, VAT number: IE8211082B, as ‘beneficiary not receiving JU funding’ (see Article 9),

26. **NAVIAIR (Naviair/COOPANS)**, established in NAVIAIR ALLE 1, KASTRUP 2770, Denmark, VAT number: DK26059763, as ‘beneficiary not receiving JU funding’ (see Article 9),

27. **ATOS BELGIUM (ATOS (FSP))**, established in DA VINCILAAN 5, ZAVENTEM 1930, Belgium, VAT number: BE0401848135, as ‘beneficiary not receiving JU funding’ (see Article 9),

28. **FREQUENTIS AG (FRQ (FSP))**, established in Innovationsstrasse 1, WIEN 1100, Austria, VAT number: ATU14715600, as ‘beneficiary not receiving JU funding’ (see Article 9),

29. **AIRTEL ATN LIMITED (AIRTEL (NATMIG))**, established in 2 HARBOUR SQUARE CROFTON ROAD, DUN LOAGHAIRE DUBLIN A96D6R0, Ireland, VAT number: IE8287698U, as ‘beneficiary not receiving JU funding’ (see Article 9),

30. **SAAB AKTIEBOLAG (SAAB (NATMIG))**, established in ., LINKOPING 581 88, Sweden, VAT number: SE556036079301, as ‘beneficiary not receiving JU funding’ (see Article 9),

31. **AEROPORTS DE PARIS SA (ADP (SEAC2020))**, established in 1 RUE DE FRANCE, TREMBLAY-EN-FRANCE 93290, France, VAT number: FR33552016628, as ‘beneficiary not receiving JU funding’ (see Article 9),

32. **FLUGHAFEN MUNCHEN GMBH (MUC (SEAC2020))**, established in NORDALLEE 25, MUNCHEN 85326, Germany, VAT number: DE129352365, as ‘beneficiary not receiving JU funding’ (see Article 9),

33. **SCHIPHOL NEDERLAND B.V. (SNBV (SEAC2020))**, established in EVERT VAN DE BEEKSTRAAT 202, LUCHTHAVEN SCHIPHOL 1118CP, Netherlands, VAT number: NL810336406B01, as ‘beneficiary not receiving JU funding’ (see Article 9),

34. **FLUGHAFEN ZURICH AG (ZRH (SEAC2020))**, established in FLUGHAFEN KLOTEN, ZURICH 8058, Switzerland, VAT number: CHE101921104MWST, as ‘beneficiary not receiving JU funding’ (see Article 9),

Unless otherwise specified, references to ‘beneficiary’ or ‘beneficiaries’ include the coordinator.

The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form, the beneficiaries accept the grant and agree to implement it under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.

The Agreement is composed of:

Terms and Conditions

- | | |
|---------|---|
| Annex 1 | Description of the action |
| Annex 2 | Estimated budget for the action |
| | 2a Additional information on the estimated budget |
| Annex 3 | Accession Forms |
| Annex 4 | Model for the financial statements |
| Annex 5 | Model for the certificate on the financial statements |
| Annex 6 | Model for the certificate on the methodology |

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CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and the terms and conditions applicable to the grant awarded to the beneficiaries for implementing the action set out in Chapter 2.

CHAPTER 2 ACTION

ARTICLE 2 — ACTION TO BE IMPLEMENTED — COMPLEMENTARY GRANT

The grant is awarded for the action entitled ‘**Airport airside and runway throughput**’ — ‘**PJ02-W2 AART**’ (**‘action’**), as described in Annex 1.

The grant is a ‘**complementary grant**’ to the grant agreement(s) under the call(s) for proposals H2020-SESAR-2019-1.

ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION

The duration of the action will be **37 months** as of 1 December 2019 (**‘starting date of the action’**).

ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS

4.1 Estimated budget

The ‘**estimated budget**’ for the action is set out in Annex 2.

It contains the estimated eligible costs and the forms of costs, broken down by beneficiary (and linked third party) and budget category (see Articles 5, 6, and 14). It also shows the estimated costs of the beneficiaries not receiving JU funding (see Article 9).

4.2 Budget transfers

The estimated budget breakdown indicated in Annex 2 may be adjusted — without an amendment (see Article 55) — by transfers of amounts between beneficiaries, budget categories and/or forms of costs set out in Annex 2, if the action is implemented as described in Annex 1.

However, the beneficiaries may not add costs relating to subcontracts not provided for in Annex 1, unless such additional subcontracts are approved by an amendment or in accordance with Article 13.

CHAPTER 3 GRANT

ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS

5.1 Maximum grant amount

The '**maximum grant amount**' is **EUR 10 628 009.21** (ten million six hundred and twenty eight thousand nine EURO and twenty one eurocents).

5.2 Form of grant, reimbursement rates and forms of costs

The grant reimburses **70% of the action's eligible costs** (see Article 6) ('**reimbursement of eligible costs grant**') (see Annex 2).

The estimated eligible costs of the action are **EUR 23 527 834.99** (twenty three million five hundred and twenty seven thousand eight hundred and thirty four EURO and ninety nine eurocents).

Eligible costs (see Article 6) must be declared under the following forms ('**forms of costs**'):

(a) for **direct personnel costs**:

- as actually incurred costs ('**actual costs**') or
- on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('**unit costs**').

Personnel **costs for SME owners or beneficiaries that are natural persons** not receiving a salary (see Article 6.2, Points A.4 and A.5) must be declared on the basis of the amount per unit set out in Annex 2a (**unit costs**);

(b) for **direct costs for subcontracting**: as actually incurred costs (**actual costs**);

(c) for **direct costs of providing financial support to third parties**: not applicable;

(d) for **other direct costs**:

- for costs of internally invoiced goods and services: on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('**unit costs**');
- for all other costs: as actually incurred costs (**actual costs**);

(e) for **indirect costs**: on the basis of a flat-rate applied as set out in Article 6.2, Point E ('**flat-rate costs**');

(f) **specific cost category(ies)**: not applicable.

5.3 Final grant amount — Calculation

The '**final grant amount**' depends on the actual extent to which the action is implemented in accordance with the Agreement's terms and conditions.

This amount is calculated by the JU — when the payment of the balance is made (see Article 21.4) — in the following steps:

Step 1 — Application of the reimbursement rates to the eligible costs

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

5.3.1 Step 1 — Application of the reimbursement rates to the eligible costs

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and linked third parties (see Article 20) and approved by the JU (see Article 21).

5.3.2 Step 2 — Limit to the maximum grant amount

If the amount obtained following Step 1 is higher than the maximum grant amount set out in Article 5.1, it will be limited to the latter.

5.3.3 Step 3 — Reduction due to the no-profit rule

The grant must not produce a profit.

‘**Profit**’ means the surplus of the amount obtained following Steps 1 and 2 plus the action’s total receipts, over the action’s total eligible costs.

The ‘**action’s total eligible costs**’ are the consolidated total eligible costs approved by the JU.

The ‘**action’s total receipts**’ are the consolidated total receipts generated during its duration (see Article 3).

The following are considered **receipts**:

- (a) income generated by the action; if the income is generated from selling equipment or other assets purchased under the Agreement, the receipt is up to the amount declared as eligible under the Agreement;
- (b) financial contributions given by third parties to the beneficiary or to a linked third party specifically to be used for the action, and
- (c) in-kind contributions provided by third parties free of charge and specifically to be used for the action, if they have been declared as eligible costs.

The following are however not considered receipts:

- (a) income generated by exploiting the action’s results (see Article 28);
- (b) financial contributions by third parties, if they may be used to cover costs other than the eligible costs (see Article 6);
- (c) financial contributions by third parties with no obligation to repay any amount unused at the end of the period set out in Article 3.

If there is a profit, it will be deducted from the amount obtained following Steps 1 and 2.

5.3.4 Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations — Reduced grant amount — Calculation

If the grant is reduced (see Article 43), the JU will calculate the reduced grant amount by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the maximum grant amount set out in Article 5.1.

The final grant amount will be the lower of the following two:

- the amount obtained following Steps 1 to 3 or
- the reduced grant amount following Step 4.

5.4 Revised final grant amount — Calculation

If — after the payment of the balance (in particular, after checks, reviews, audits or investigations; see Article 22) — the JU rejects costs (see Article 42) or reduces the grant (see Article 43), it will calculate the ‘**revised final grant amount**’ for the beneficiary concerned by the findings.

This amount is calculated by the JU on the basis of the findings, as follows:

- in case of **rejection of costs**: by applying the reimbursement rate to the revised eligible costs approved by the JU for the beneficiary concerned;
- in case of **reduction of the grant**: by calculating the concerned beneficiary’s share in the grant amount reduced in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations (see Article 43.2).

In case of **rejection of costs and reduction of the grant**, the revised final grant amount for the beneficiary concerned will be the lower of the two amounts above.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS

6.1 General conditions for costs to be eligible

‘**Eligible costs**’ are costs that meet the following criteria:

(a) for **actual costs**:

- (i) they must be actually incurred by the beneficiary;
- (ii) they must be incurred in the period set out in Article 3, with the exception of costs relating to the submission of the periodic report for the last reporting period and the final report (see Article 20);
- (iii) they must be indicated in the estimated budget set out in Annex 2;
- (iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation;
- (v) they must be identifiable and verifiable, in particular recorded in the beneficiary’s accounts

in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices;

- (vi) they must comply with the applicable national law on taxes, labour and social security, and
- (vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

(b) for **unit costs**:

- (i) they must be calculated as follows:

{amounts per unit set out in Annex 2a or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A and Article 6.2.D.5)

multiplied by

the number of actual units};

- (ii) the number of actual units must comply with the following conditions:

- the units must be actually used or produced in the period set out in Article 3;
- the units must be necessary for implementing the action or produced by it, and
- the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 18);

(c) for **flat-rate costs**:

- (i) they must be calculated by applying the flat-rate set out in Annex 2, and
- (ii) the costs (actual costs or unit costs) to which the flat-rate is applied must comply with the conditions for eligibility set out in this Article.

6.2 Specific conditions for costs to be eligible

Costs are eligible if they comply with the general conditions (see above) and the specific conditions set out below for each of the following budget categories:

- A. direct personnel costs;
- B. direct costs of subcontracting;
- C. not applicable;
- D. other direct costs;
- E. indirect costs;
- F. not applicable.

'Direct costs' are costs that are directly linked to the action implementation and can therefore be attributed to it directly. They must not include any indirect costs (see Point E below).

'Indirect costs' are costs that are not directly linked to the action implementation and therefore cannot be attributed directly to it.

A. Direct personnel costs

Types of eligible personnel costs

A.1 Personnel costs are eligible, if they are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action (**‘costs for employees (or equivalent)’**). They must be limited to salaries (including during parental leave), social security contributions, taxes and other costs included in the **remuneration**, if they arise from national law or the employment contract (or equivalent appointing act).

Beneficiaries that are non-profit legal entities² may also declare as personnel costs **additional remuneration** for personnel assigned to the action (including payments on the basis of supplementary contracts regardless of their nature), if:

- (a) it is part of the beneficiary’s usual remuneration practices and is paid in a consistent manner whenever the same kind of work or expertise is required;
- (b) the criteria used to calculate the supplementary payments are objective and generally applied by the beneficiary, regardless of the source of funding used.

‘Additional remuneration’ means any part of the remuneration which exceeds what the person would be paid for time worked in projects funded by national schemes.

Additional remuneration for personnel assigned to the action is eligible up to the following amount:

- (a) if the person works full time and exclusively on the action during the full year: up to EUR 8 000;
- (b) if the person works exclusively on the action but not full-time or not for the full year: up to the corresponding pro-rata amount of EUR 8 000, or
- (c) if the person does not work exclusively on the action: up to a pro-rata amount calculated as follows:

{EUR 8 000

divided by

the number of annual productive hours (see below)},

multiplied by

the number of hours that the person has worked on the action during the year}.

A.2 The **costs for natural persons working under a direct contract** with the beneficiary other than an employment contract are eligible personnel costs, if:

- (a) the person works under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed);
- (b) the result of the work carried out belongs to the beneficiary (unless exceptionally agreed otherwise), and

² For the definition, see Article 2.1(14) of the Rules for Participation Regulation No 1290/2013: ‘**non-profit legal entity**’ means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

- (c) the costs are not significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.3 The **costs of personnel seconded by a third party against payment** are eligible personnel costs, if the conditions in Article 11.1 are met.

A.4 **Costs of owners** of beneficiaries that are small and medium-sized enterprises (**'SME owners'**) who are working on the action and who do not receive a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.

A.5 **Costs of 'beneficiaries that are natural persons'** not receiving a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.

Calculation

Personnel costs must be calculated by the beneficiaries as follows:

{ {hourly rate
multiplied by
the number of actual hours worked on the action},
plus
for non-profit legal entities: additional remuneration to personnel assigned to the action under the
conditions set out above (Point A.1)}.

The number of actual hours declared for a person must be identifiable and verifiable (see Article 18).

The total number of hours declared in JU, EU or Euratom grants, for a person for a year, cannot be higher than the annual productive hours used for the calculations of the hourly rate. Therefore, the maximum number of hours that can be declared for the grant are:

{number of annual productive hours for the year (see below)
minus
total number of hours declared by the beneficiary, for that person in that year, for other JU, EU or
Euratom grants}.

The **'hourly rate'** is one of the following:

- (a) for personnel costs declared as **actual costs** (i.e. budget categories A.1, A.2, A.3): the hourly rate is calculated *per full financial year*, as follows:

{actual annual personnel costs (excluding additional remuneration) for the person
divided by
number of annual productive hours}.

using the personnel costs and the number of productive hours for each full financial year covered by the reporting period concerned. If a financial year is not closed at the end of the

reporting period, the beneficiaries must use the hourly rate of the last closed financial year available.

For the ‘number of annual productive hours’, the beneficiaries may choose one of the following:

- (i) ‘fixed number of hours’: 1 720 hours for persons working full time (or corresponding pro-rata for persons not working full time);
- (ii) ‘individual annual productive hours’: the total number of hours worked by the person in the year for the beneficiary, calculated as follows:

{annual workable hours of the person (according to the employment contract, applicable collective labour agreement or national law)

plus

overtime worked

minus

absences (such as sick leave and special leave)}.

‘Annual workable hours’ means the period during which the personnel must be working, at the employer’s disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.

If the contract (or applicable collective labour agreement or national working time legislation) does not allow to determine the annual workable hours, this option cannot be used;

- (iii) ‘standard annual productive hours’: the ‘standard number of annual hours’ generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the ‘standard annual workable hours’.

If there is no applicable reference for the standard annual workable hours, this option cannot be used.

For all options, the actual time spent on **parental leave** by a person assigned to the action may be deducted from the number of annual productive hours.

As an alternative, beneficiaries may calculate the hourly rate *per month*, as follows:

{actual monthly personnel cost (excluding additional remuneration) for the person

divided by

{number of annual productive hours / 12}}}

using the personnel costs for each month and (one twelfth of) the annual productive hours calculated according to either option (i) or (iii) above, i.e.:

- fixed number of hours or
- standard annual productive hours.



Time spent on **parental leave** may not be deducted when calculating the hourly rate per month. However, beneficiaries may declare personnel costs incurred in periods of parental leave in proportion to the time the person worked on the action in that financial year.

If parts of a basic remuneration are generated over a period longer than a month, the beneficiaries may include only the share which is generated in the month (irrespective of the amount actually paid for that month).

Each beneficiary must use only one option (per full financial year or per month) for each full financial year;

(b) for personnel costs declared on the basis of **unit costs** (i.e. budget categories A.1, A.2, A.4, A.5): the hourly rate is one of the following:

- (i) for SME owners or beneficiaries that are natural persons: the hourly rate set out in Annex 2a (see Points A.4 and A.5 above), or
- (ii) for personnel costs declared on the basis of the beneficiary's usual cost accounting practices: the hourly rate calculated by the beneficiary in accordance with its usual cost accounting practices, if:
 - the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
 - the hourly rate is calculated using the actual personnel costs recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual personnel costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information;

and

- the hourly rate is calculated using the number of annual productive hours (see above).

B. Direct costs of subcontracting (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if the conditions in Article 13.1.1 are met.

C. Direct costs of providing financial support to third parties

Not applicable

D. Other direct costs

D.1 Travel costs and related subsistence allowances (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if they are in line with the beneficiary's usual practices on travel.

D.2 The depreciation costs of equipment, infrastructure or other assets (new or second-hand) as recorded in the beneficiary's accounts are eligible, if they were purchased in accordance with

Article 10.1.1 and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

The **costs of renting or leasing** equipment, infrastructure or other assets (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

The costs of equipment, infrastructure or other assets **contributed in-kind against payment** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets, do not include any financing fees and if the conditions in Article 11.1 are met.

The only portion of the costs that will be taken into account is that which corresponds to the duration of the action and rate of actual use for the purposes of the action.

D.3 Costs of other goods and services (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible, if they are:

- (a) purchased specifically for the action and in accordance with Article 10.1.1 or
- (b) contributed in kind against payment and in accordance with Article 11.1.

Such goods and services include, for instance, consumables and supplies, dissemination (including open access), protection of results, certificates on the financial statements (if they are required by the Agreement), certificates on the methodology, translations and publications.

D.4 Capitalised and operating costs of 'large research infrastructure'³: Not applicable

D.5 Costs of internally invoiced goods and services directly used for the action are eligible, if:

- (a) they are declared on the basis of a unit cost calculated in accordance with the beneficiary's usual cost accounting practices;
- (b) the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
- (c) the unit cost is calculated using the actual costs for the good or service recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the costs, reasonable and correspond to objective and verifiable information;

- (d) the unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.

'Internally invoiced goods and services' means goods or services which are provided by the

³ **'Large research infrastructure'** means research infrastructure of a total value of at least EUR 20 million, for a beneficiary, calculated as the sum of historical asset values of each individual research infrastructure of that beneficiary, as they appear in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure.

beneficiary directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

E. Indirect costs

Indirect costs are eligible if they are declared on the basis of the flat-rate of 25% of the eligible direct costs (see Article 5.2 and Points A to D above), from which are excluded:

- (a) costs of subcontracting and
- (b) costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises;
- (c) not applicable;
- (d) not applicable.

Beneficiaries receiving an operating grant⁵ financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action.

F. Specific cost category(ies)

Not applicable

6.3 Conditions for costs of linked third parties to be eligible

Costs incurred by linked third parties are eligible if they fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 14.1.1.

6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible

In-kind contributions provided free of charge are eligible direct costs (for the beneficiary or linked third party), if the costs incurred by the third party fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 12.1.

6.5 Ineligible costs

'Ineligible costs' are:

- (a) costs that do not comply with the conditions set out above (Article 6.1 to 6.4), in particular:
 - (i) costs related to return on capital;
 - (ii) debt and debt service charges;

⁵ For the definition, see Article 121(1)(b) of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 ('**Financial Regulation No 966/2012**') (OJ L 218, 26.10.2012, p.1): '**operating grant**' means direct financial contribution, by way of donation, from the budget in order to finance the functioning of a body which pursues an aim of general EU interest or has an objective forming part of and supporting an EU policy.

- (iii) provisions for future losses or debts;
 - (iv) interest owed;
 - (v) doubtful debts;
 - (vi) currency exchange losses;
 - (vii) bank costs charged by the beneficiary's bank for transfers from the JU;
 - (viii) excessive or reckless expenditure;
 - (ix) deductible VAT;
 - (x) costs incurred during suspension of the implementation of the action (see Article 49);
- (b) costs declared under another JU, EU or Euratom grant (including other grants awarded by the JU, grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the JU for the purpose of implementing the EU or Euratom budget); in particular, indirect costs if the beneficiary is already receiving an operating grant financed by the EU or Euratom budget in the same period, unless it can demonstrate that the operating grant does not cover any costs of the action.

6.6 Consequences of declaration of ineligible costs

Declared costs that are ineligible will be rejected (see Article 42).

This may also lead to any of the other measures described in Chapter 6.

CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES

SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION

ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION

7.1 General obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement and all legal obligations under applicable EU, international and national law.

7.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION

The beneficiaries must have the appropriate resources to implement the action.

If it is necessary to implement the action, the beneficiaries may:

- purchase goods, works and services (see Article 10);
- use in-kind contributions provided by third parties against payment (see Article 11);
- use in-kind contributions provided by third parties free of charge (see Article 12);
- call upon subcontractors to implement action tasks described in Annex 1 (see Article 13);
- call upon linked third parties to implement action tasks described in Annex 1 (see Article 14);
- call upon international partners to implement action tasks described in Annex 1 (see Article 14a).

In these cases, the beneficiaries retain sole responsibility towards the JU and the other beneficiaries for implementing the action.

ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING JU FUNDING

9.1 Rules for the implementation of action tasks by beneficiaries not receiving JU funding

Beneficiaries that are not eligible for JU funding or request zero JU funding (**‘beneficiaries not receiving JU funding’**) must implement the action tasks attributed to them in Annex 1 in accordance with Article 7.1.

Their costs are estimated in Annex 2 but:

- will not be reimbursed and
- will not be taken into account for the calculation of the grant (see Articles 5.2, 5.3 and 5.4, and 21).

Chapter 3, Articles 10 to 15, 18.1.2, 20.3(b), 20.4(b), 20.6, 21, 23a, 26.4, 27.2, 28.1, 28.2, 30.3, 31.5, 40, 42, 43, 44, 47 and 48 do not apply to ON (B4), AIRTEL (NATMIG), Naviair/COOPANS, ATOS (FSP), ADP (SEAC2020), FRQ (FSP), ANS CR (B4), IAA/COOPANS, ZRH (SEAC2020), SAAB (NATMIG), LPS SR (B4), MUC (SEAC2020), CCL/COOPANS, SNBV (SEAC2020), ACG/COOPANS.

They will not be subject to financial checks, reviews and audits under Article 22.

Chapter 3, Articles 10 to 15, 18.1.2, 20.6, 23a, 26.4, 27.2, 28.1, 28.2, 30.3, 31.5 and 40 do not apply to EUROCONTROL.

The beneficiary will not be subject to financial checks, reviews and audits under Article 22 for its own costs.

Beneficiaries not receiving JU funding may provide in-kind contributions to another beneficiary. In this case, they will be considered as a third party for the purpose of Articles 11 and 12.

If a beneficiary requesting zero funding receives funding later on (through an amendment; see Article 55), all obligations will apply retroactively.

9.2 Consequences of non-compliance

If a beneficiary not receiving JU funding breaches any of its obligations under this Article, its participation in the Agreement may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6 that are applicable to it.

ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES

10.1 Rules for purchasing goods, works or services

10.1.1 If necessary to implement the action, the beneficiaries may purchase goods, works or services.

The beneficiaries must make such purchases ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their contractors.

10.1.2 Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC⁶ (or 2014/24/EU⁷) or ‘contracting entities’ within the meaning of Directive 2004/17/EC⁸ (or 2014/25/EU⁹) must comply with the applicable national law on public procurement.

10.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 10.1.1, the costs related to the contract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 10.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

⁶ Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts (OJ L 134, 30.04.2004, p. 114).

⁷ Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. (OJ L 94, 28.03.2014, p. 65).

⁸ Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (OJ L 134, 30.04.2004, p. 1)

⁹ Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC (OJ L 94, 28.03.2014, p. 243).

ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT

11.1 Rules for the use of in-kind contributions against payment

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties against payment.

The beneficiaries may declare costs related to the payment of in-kind contributions as eligible (see Article 6.1 and 6.2), up to the third parties' costs for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services.

The third parties and their contributions must be set out in Annex 1. The JU may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs related to the payment of the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE

12.1 Rules for the use of in-kind contributions free of charge

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties free of charge.

The beneficiaries may declare costs incurred by the third parties for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services as eligible in accordance with Article 6.4.

The third parties and their contributions must be set out in Annex 1. The JU may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA)

and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs incurred by the third parties related to the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS

13.1 Rules for subcontracting action tasks

13.1.1 If necessary to implement the action, the beneficiaries may award subcontracts covering the implementation of certain action tasks described in Annex 1.

Subcontracting may cover only a limited part of the action.

The beneficiaries must award the subcontracts ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The tasks to be implemented and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2. The JU may however approve subcontracts not set out in Annex 1 and 2 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- they do not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their subcontractors.

13.1.2 The beneficiaries must ensure that their obligations under Articles 35, 36, 38 and 46 also apply to the subcontractors.

Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC (or 2014/24/EU) or ‘contracting entities’ within the meaning of Directive 2004/17/EC (or 2014/25/EU) must comply with the applicable national law on public procurement.

13.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 13.1.1, the costs related to the subcontract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 13.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES

14.1 Rules for calling upon linked third parties to implement part of the action

14.1.1 The following **affiliated entities**¹¹ and **third parties with a legal link to a beneficiary**¹² (**‘linked third parties’**) may implement the action tasks attributed to them in Annex 1:

- AIRBUS OPERATIONS SAS (AI OP SAS), affiliated or linked to AIRBUS SAS
- WASKO S.A. (WASKO S.A.), affiliated or linked to PANSA (B4)
- MICROSTEP-MIS SPOL SRO (MICROSTEP-MIS), affiliated or linked to PANSA (B4)
- UNIWERSYTET WARSZAWSKI (UNIWARSAW), affiliated or linked to PANSA (B4)
- CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E. (CRIDA), affiliated or linked to ENAIRE
- NEXTANT APPLICATIONS & INNOVATIVE SOLUTION SRL (NAIS), affiliated or linked to ENAV
- IDS AIRNAV SRL (IDS AIRNAV), affiliated or linked to ENAV
- TECHNO SKY S.R.L. (TECHNO SKY), affiliated or linked to ENAV
- NAV CANADA (NAV CANADA), affiliated or linked to ENAV
- HONEYWELL INTERNATIONAL INC (HIinc), affiliated or linked to Honeywell SAS
- HONEYWELL INTERNATIONAL SRO (HIsro), affiliated or linked to Honeywell SAS
- INDRA NAVIA AS (INDRA NAVIA), affiliated or linked to INDRA
- INDRA BUSINESS CONSULTING (IBC), affiliated or linked to INDRA
- LEONARDO GERMANY GMBH (LDO GMBH), affiliated or linked to LDO

¹¹ For the definition see Article 2.1(2) Rules for Participation Regulation No 1290/2013: **‘affiliated entity’** means any legal entity that is:

- under the direct or indirect control of a participant, or
- under the same direct or indirect control as the participant, or
- directly or indirectly controlling a participant.

‘Control’ may take any of the following forms:

- (a) the direct or indirect holding of more than 50% of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;
- (b) the direct or indirect holding, in fact or in law, of decision-making powers in the legal entity concerned.

However the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:

- (a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;
- (b) the legal entities concerned are owned or supervised by the same public body.

¹² **‘Third party with a legal link to a beneficiary’** is any legal entity which has a legal link to the beneficiary implying collaboration that is not limited to the action.

- TELESPAZIO SPA (TPZ), affiliated or linked to LDO
- SEARIDGE TECHNOLOGIES INC. (SEARIDGE), affiliated or linked to THALES AIR SYS
- NAVEGACAO AEREA DE PORTUGAL - NAV PORTUGAL EPE (NAV PORTUGAL), affiliated or linked to THALES AIR SYS
- EDISOFT-EMPRESA DE SERVICOS E DESENVOLVIMENTO DE SOFTWARE SA (EDISOFT), affiliated or linked to THALES AIR SYS

The linked third parties may declare as eligible the costs they incur for implementing the action tasks in accordance with Article 6.3.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their linked third parties.

14.1.2 The beneficiaries must ensure that their obligations under Articles 18, 20, 35, 36 and 38 also apply to their linked third parties.

14.2 Consequences of non-compliance

If any obligation under Article 14.1.1 is breached, the costs of the linked third party will be ineligible (see Article 6) and will be rejected (see Article 42).

If any obligation under Article 14.1.2 is breached, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14a — IMPLEMENTATION OF ACTION TASKS BY INTERNATIONAL PARTNERS

Not applicable

ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES

15.1 Rules for providing financial support to third parties

Not applicable

15.2 Financial support in the form of prizes

Not applicable

15.3 Consequences of non-compliance

Not applicable

ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE

16.1 Rules for providing trans-national access to research infrastructure

Not applicable

16.2 Rules for providing virtual access to research infrastructure

Not applicable

16.3 Consequences of non-compliance

Not applicable

SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION

ARTICLE 17 — GENERAL OBLIGATION TO INFORM**17.1 General obligation to provide information upon request**

The beneficiaries must provide — during implementation of the action or afterwards and in accordance with Article 41.2 — any information requested in order to verify eligibility of the costs, proper implementation of the action and compliance with any other obligation under the Agreement.

17.2 Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement

Each beneficiary must keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system; see Article 52) up to date, in particular, its name, address, legal representatives, legal form and organisation type.

Each beneficiary must immediately inform the coordinator — which must immediately inform the JU and the other beneficiaries — of any of the following:

- (a) **events** which are likely to affect significantly or delay the implementation of the action or the EU's or the JU's financial interests, in particular:
 - (i) changes in its legal, financial, technical, organisational or ownership situation or those of its linked third parties and
 - (ii) changes in the name, address, legal form, organisation type of its linked third parties;
- (b) **circumstances** affecting:
 - (i) the decision to award the grant or
 - (ii) compliance with requirements under the Agreement.

17.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION

18.1 Obligation to keep records and other supporting documentation

The beneficiaries must — for a period of five years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible.

They must make them available upon request (see Article 17) or in the context of checks, reviews, audits or investigations (see Article 22).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 22), the beneficiaries must keep the records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The JU or the Commission may accept non-original documents if it considers that they offer a comparable level of assurance.

18.1.1 Records and other supporting documentation on the scientific and technical implementation

The beneficiaries must keep records and other supporting documentation on scientific and technical implementation of the action in line with the accepted standards in the respective field.

18.1.2 Records and other documentation to support the costs declared

The beneficiaries must keep the records and documentation supporting the costs declared, in particular the following:

- (a) for **actual costs**: adequate records and other supporting documentation to prove the costs declared, such as contracts, subcontracts, invoices and accounting records. In addition, the beneficiaries' usual cost accounting practices and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documentation;
- (b) for **unit costs**: adequate records and other supporting documentation to prove the number of units declared. Beneficiaries do not need to identify the actual eligible costs covered or to keep or provide supporting documentation (such as accounting statements) to prove the amount per unit.

In addition, for **unit costs calculated in accordance with the beneficiary's usual cost accounting practices**, the beneficiaries must keep adequate records and documentation to prove that the cost accounting practices used comply with the conditions set out in Article 6.2.

The beneficiaries and linked third parties may submit to the JU, for approval by the Commission, a certificate (drawn up in accordance with Annex 6) stating that their usual cost accounting practices comply with these conditions (**'certificate on the methodology'**). If the certificate is approved, costs declared in line with this methodology will not be challenged

subsequently, unless the beneficiaries have concealed information for the purpose of the approval.

- (c) for **flat-rate costs**: adequate records and other supporting documentation to prove the eligibility of the costs to which the flat-rate is applied. The beneficiaries do not need to identify the costs covered or provide supporting documentation (such as accounting statements) to prove the amount declared at a flat-rate.

In addition, for **personnel costs** (declared as actual costs or on the basis of unit costs), the beneficiaries must keep **time records** for the number of hours declared. The time records must be in writing and approved by the persons working on the action and their supervisors, at least monthly. In the absence of reliable time records of the hours worked on the action, the JU or the Commission may accept alternative evidence supporting the number of hours declared, if it considers that it offers an adequate level of assurance.

As an exception, for **persons working exclusively on the action**, there is no need to keep time records, if the beneficiary signs a **declaration** confirming that the persons concerned have worked exclusively on the action.

For costs declared by linked third parties (see Article 14), it is the beneficiary that must keep the originals of the financial statements and the certificates on the financial statements of the linked third parties.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 42), and the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 19 — SUBMISSION OF DELIVERABLES

19.1 Obligation to submit deliverables

The coordinator must submit the ‘**deliverables**’ identified in Annex 1, in accordance with the timing and conditions set out in it.

19.2 Consequences of non-compliance

If the coordinator breaches any of its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

ARTICLE 20 — REPORTING — PAYMENT REQUESTS

20.1 Obligation to submit reports

The coordinator must submit to the JU (see Article 52) the technical and financial reports set out in this Article. These reports include requests for payment and must be drawn up using the forms and templates provided in the electronic exchange system (see Article 52).

20.2 Reporting periods

The action is divided into the following ‘**reporting periods**’:

- RP1: from month 1 to month 13
- RP2: from month 14 to month 25
- RP3: from month 26 to month 37

20.3 Periodic reports — Requests for interim payments

The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The **periodic report** must include the following:

(a) a ‘**periodic technical report**’ containing:

- (i) an **explanation of the work carried out** by the beneficiaries;
- (ii) an **overview of the progress** towards the objectives of the action, including milestones and deliverables identified in Annex 1.

This report must include explanations justifying the differences between work expected to be carried out in accordance with Annex 1 and that actually carried out.

The report must detail the exploitation and dissemination of the results and — if required in Annex 1 — an updated ‘**plan for the exploitation and dissemination of the results**’.

The report must indicate the communication activities;

- (iii) a **summary** for publication by the JU;
- (iv) the answers to the ‘**questionnaire**’, covering issues related to the action implementation and the economic and societal impact, notably in the context of the JU and the Horizon 2020 key performance indicators and JU and the Horizon 2020 monitoring requirements;

(b) a ‘**periodic financial report**’ containing:

- (i) an ‘**individual financial statement**’ (see Annex 4) from each beneficiary and from each linked third party, for the reporting period concerned.

The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) for each budget category (see Annex 2).

The beneficiaries and linked third parties must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts which are not declared in the individual financial statement will not be taken into account by the JU.

If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period.

The individual financial statements of the last reporting period must also detail the **receipts of the action** (see Article 5.3.3).

Each beneficiary and each linked third party must **certify** that:

- the information provided is full, reliable and true;
 - the costs declared are eligible (see Article 6);
 - the costs can be substantiated by adequate records and supporting documentation (see Article 18) that will be produced upon request (see Article 17) or in the context of checks, reviews, audits and investigations (see Article 22), and
 - for the last reporting period: that all the receipts have been declared (see Article 5.3.3);
- (ii) an **explanation of the use of resources** and the information on subcontracting (see Article 13) and in-kind contributions provided by third parties (see Articles 11 and 12) from each beneficiary and from each linked third party, for the reporting period concerned;
- (iii) not applicable;
- (iv) a '**periodic summary financial statement**', created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the **request for interim payment**.

20.4 Final report — Request for payment of the balance

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The **final report** must include the following:

- (a) a '**final technical report**' with a **summary** for publication containing:
- (i) an overview of the results and their exploitation and dissemination;
 - (ii) the conclusions on the action, and
 - (iii) the socio-economic impact of the action;
- (b) a '**final financial report**' containing:
- (i) a '**final summary financial statement**', created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the **request for payment of the balance** and
 - (ii) a '**certificate on the financial statements**' (drawn up in accordance with Annex 5) for each beneficiary and for each linked third party, if it requests a total contribution of

EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 5.2 and Article 6.2).

20.5 Information on cumulative expenditure incurred

Not applicable

20.6 Currency for financial statements and conversion into euro

Financial statements must be drafted in euro.

Beneficiaries and linked third parties with accounting established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union*, calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal of the European Union* for the currency in question, they must be converted at the average of the monthly accounting rates published on the Commission's website, calculated over the corresponding reporting period.

Beneficiaries and linked third parties with accounting established in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

20.7 Language of reports

All reports (technical and financial reports, including financial statements) must be submitted in the language of the Agreement.

20.8 Consequences of non-compliance

If the reports submitted do not comply with this Article, the JU may suspend the payment deadline (see Article 47) and apply any of the other measures described in Chapter 6.

If the coordinator breaches its obligation to submit the reports and if it fails to comply with this obligation within 30 days following a written reminder, the JU may terminate the Agreement (see Article 50) or apply any of the other measures described in Chapter 6.

ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS

21.1 Payments to be made

The following payments will be made to the coordinator:

- one **pre-financing payment**;
- one or more **interim payments**, on the basis of the request(s) for interim payment (see Article 20), and
- one **payment of the balance**, on the basis of the request for payment of the balance (see Article 20).

21.2 Pre-financing payment — Amount — Amount retained for the Guarantee Fund

The aim of the pre-financing is to provide the beneficiaries with a float.

It remains the property of the JU until the payment of the balance.

The amount of the pre-financing payment will be EUR **6 376 805.53** (six million three hundred and seventy six thousand eight hundred and five EURO and fifty three eurocents).

The JU will — except if Article 48 applies — make the pre-financing payment to the coordinator within 30 days, either from the entry into force of the Agreement (see Article 58) or from 10 days before the starting date of the action (see Article 3), whichever is the latest.

An amount of EUR **531 400.46** (five hundred and thirty one thousand four hundred EURO and forty six eurocents), corresponding to 5% of the maximum grant amount (see Article 5.1), is retained by the JU from the pre-financing payment and transferred into the '**Guarantee Fund**'.

21.3 Interim payments — Amount — Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The JU will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as interim payment** is calculated by the JU in the following steps:

Step 1 — Application of the reimbursement rates

Step 2 — Limit to 90% of the maximum grant amount

21.3.1 Step 1 — Application of the reimbursement rates

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and the linked third parties (see Article 20) and approved by the JU (see above) for the concerned reporting period.

21.3.2 Step 2 — Limit to 90% of the maximum grant amount

The total amount of pre-financing and interim payments must not exceed 90% of the maximum grant amount set out in Article 5.1. The maximum amount for the interim payment will be calculated as follows:

{90% of the maximum grant amount (see Article 5.1)

minus

{pre-financing and previous interim payments} }.

21.4 Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund

The payment of the balance reimburses the remaining part of the eligible costs incurred by the beneficiaries for the implementation of the action.

If the total amount of earlier payments is greater than the final grant amount (see Article 5.3), the payment of the balance takes the form of a recovery (see Article 44).

If the total amount of earlier payments is lower than the final grant amount, the JU will pay the balance within 90 days from receiving the final report (see Article 20.4), except if Articles 47 or 48 apply.

Payment is subject to the approval of the final report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as the balance** is calculated by the JU by deducting the total amount of pre-financing and interim payments (if any) already made, from the final grant amount determined in accordance with Article 5.3:

$$\begin{aligned} & \{\text{final grant amount (see Article 5.3)} \\ & \text{minus} \\ & \{\text{pre-financing and interim payments (if any) made}\}. \end{aligned}$$

At the payment of the balance, the amount retained for the Guarantee Fund (see above) will be released and:

- if the balance is positive: the amount released will be paid in full to the coordinator together with the amount due as the balance;
- if the balance is negative (payment of the balance taking the form of recovery): it will be deducted from the amount released (see Article 44.1.2). If the resulting amount:
 - is positive, it will be paid to the coordinator
 - is negative, it will be recovered.

The amount to be paid may however be offset — without the beneficiaries' consent — against any other amount owed by a beneficiary to the JU up to the maximum JU contribution indicated, for that beneficiary, in the estimated budget (see Annex 2).

21.5 Notification of amounts due

When making payments, the JU will formally notify to the coordinator the amount due, specifying whether it concerns an interim payment or the payment of the balance.

For the payment of the balance, the notification will also specify the final grant amount.

In the case of reduction of the grant or recovery of undue amounts, the notification will be preceded by the contradictory procedure set out in Articles 43 and 44.

21.6 Currency for payments

The JU will make all payments in euro.

21.7 Payments to the coordinator — Distribution to the beneficiaries

Payments will be made to the coordinator.

Payments to the coordinator will discharge the JU from its payment obligation.

The coordinator must distribute the payments between the beneficiaries without unjustified delay.

Pre-financing may however be distributed only:

- (a) if the minimum number of beneficiaries set out in the call for proposals has acceded to the Agreement (see Article 56) and
- (b) to beneficiaries that have acceded to the Agreement (see Article 56).

21.8 Bank account for payments

All payments will be made to the following bank account:

Name of bank: ING BELGIUM NV/SA (FORMERLY BANK BRUSSELS LAMBERT SA),
BRUSS
Full name of the account holder: EUROCONTROL AGENCY DIVISION DR AD TR
IBAN code: BE36310109735681

21.9 Costs of payment transfers

The cost of the payment transfers is borne as follows:

- the JU bears the cost of transfers charged by its bank;
- the beneficiary bears the cost of transfers charged by its bank;
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

21.10 Date of payment

Payments by the JU are considered to have been carried out on the date when they are debited to its account.

21.11 Consequences of non-compliance

21.11.1 If the JU does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus three and a half points. The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only upon request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

Suspension of the payment deadline or payments (see Articles 47 and 48) will not be considered as late payment.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

21.11.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or the participation of the coordinator may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

22.1 Checks, reviews and audits by the JU and the Commission

22.1.1 Right to carry out checks

The JU will — during the implementation of the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing deliverables and reports.

For this purpose the JU may be assisted by external persons or bodies.

The JU may also request additional information in accordance with Article 17. The JU may request beneficiaries to provide such information to it directly.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

22.1.2 Right to carry out reviews

The JU may — during the implementation of the action or afterwards — carry out reviews on the proper implementation of the action (including assessment of deliverables and reports), compliance with the obligations under the Agreement and continued scientific or technological relevance of the action.

Reviews may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the review is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The JU may carry out reviews directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The JU may request beneficiaries to provide such information to it directly.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with external experts.

For **on-the-spot** reviews, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a '**review report**' will be drawn up.

The JU will formally notify the review report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory review procedure**').

Reviews (including review reports) are in the language of the Agreement.

22.1.3 Right to carry out audits

The JU or the Commission may — during the implementation of the action or afterwards — carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Audits may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the audit is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The JU or the Commission may carry out audits directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. The JU or the Commission may request beneficiaries to provide such information to it directly.

For **on-the-spot** audits, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a '**draft audit report**' will be drawn up.

The JU or the Commission will formally notify the draft audit report to the coordinator or beneficiary

concerned, which has 30 days to formally notify observations (**‘contradictory audit procedure’**). This period may be extended by the JU or the Commission in justified cases.

The **‘final audit report’** will take into account observations by the coordinator or beneficiary concerned. The report will be formally notified to it.

Audits (including audit reports) are in the language of the Agreement.

The JU or the Commission may also access the beneficiaries’ statutory records for the periodical assessment of unit costs or flat-rate amounts.

22.2 Investigations by the European Anti-Fraud Office (OLAF)

Under Regulations No 883/2013¹⁶ and No 2185/96¹⁷ (and in accordance with their provisions and procedures), and Article 110 of the JU Financial Rules¹⁸, the European Anti-Fraud Office (OLAF) may — at any moment during implementation of the action or afterwards — carry out investigations, including on-the-spot checks and inspections, to establish whether there has been fraud, corruption or any other illegal activity affecting the financial interests of the EU.

22.3 Checks and audits by the European Court of Auditors (ECA)

Under Article 287 of the Treaty on the Functioning of the European Union (TFEU) and Article 110 of the JU Financial Rules, the European Court of Auditors (ECA) may — at any moment during implementation of the action or afterwards — carry out audits.

The ECA has the right of access for the purpose of checks and audits.

22.4 Checks, reviews, audits and investigations for international organisations

In conformity with its financial regulations, the European Union, including the European Anti-Fraud Office (OLAF) and the European Court of Auditors (ECA), may undertake, including on the spot, checks, reviews, audits and investigations.

This Article will be applied in accordance with any specific agreement concluded in this respect by the international organisation and the European Union.

22.5 Consequences of findings in checks, reviews, audits and investigations — Extension of findings

22.5.1 Findings in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead

¹⁶ Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18.09.2013, p. 1).

¹⁷ Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities’ financial interests against fraud and other irregularities (OJ L 292, 15.11.1996, p. 2).

¹⁸ The SESAR JU Financial Rules are made publicly available on the SESAR JU official website.

to the rejection of ineligible costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44) or to any of the other measures described in Chapter 6.

Rejection of costs or reduction of the grant after the payment of the balance will lead to a revised final grant amount (see Article 5.4).

Findings in checks, reviews, audits or investigations may lead to a request for amendment for the modification of Annex 1 (see Article 55).

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations may also lead to consequences in other JU, EU or Euratom grants awarded under similar conditions (**‘extension of findings from this grant to other grants’**).

Moreover, findings arising from an OLAF investigation may lead to criminal prosecution under national law.

22.5.2 Findings in other grants

The JU or the Commission may extend findings from other grants to this grant (**‘extension of findings from other grants to this grant’**), if:

- (a) the beneficiary concerned is found, in other JU, EU or Euratom grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and
- (b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — no later than two years after the payment of the balance of this grant.

The extension of findings may lead to the rejection of costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44), suspension of payments (see Article 48), suspension of the action implementation (see Article 49) or termination (see Article 50).

22.5.3 Procedure

The JU or the Commission will formally notify the beneficiary concerned the systemic or recurrent errors and its intention to extend these audit findings, together with the list of grants affected.

22.5.3.1 If the findings concern **eligibility of costs**: the formal notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings;
- (b) the request to submit **revised financial statements** for all grants affected;
- (c) the **correction rate for extrapolation** established by the JU or the Commission on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected if the beneficiary concerned:
 - (i) considers that the submission of revised financial statements is not possible or practicable or
 - (ii) does not submit revised financial statements.

The beneficiary concerned has 90 days from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method**. This period may be extended by the JU or the Commission in justified cases.

The JU or the Commission may then start a rejection procedure in accordance with Article 42, on the basis of:

- the revised financial statements, if approved;
- the proposed alternative correction method, if accepted

or

- the initially notified correction rate for extrapolation, if it does not receive any observations or revised financial statements, does not accept the observations or the proposed alternative correction method or does not approve the revised financial statements.

22.5.3.2 If the findings concern **substantial errors, irregularities or fraud or serious breach of obligations**: the formal notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings and
- (b) the flat-rate the JU or the Commission intends to apply according to the principle of proportionality.

The beneficiary concerned has 90 days from receiving notification to submit observations or to propose a duly substantiated alternative flat-rate.

The JU or the Commission may then start a reduction procedure in accordance with Article 43, on the basis of:

- the proposed alternative flat-rate, if accepted

or

- the initially notified flat-rate, if it does not receive any observations or does not accept the observations or the proposed alternative flat-rate.

22.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, any insufficiently substantiated costs will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION

23.1 Right to evaluate the impact of the action

The JU or the Commission may carry out interim and final evaluations of the impact of the action measured against the objective of the EU programme.

Evaluations may be started during implementation of the action and up to five years after the payment

of the balance. The evaluation is considered to start on the date of the formal notification to the coordinator or beneficiaries.

The JU or the Commission may make these evaluations directly (using its own staff) or indirectly (using external bodies or persons it has authorised to do so).

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

23.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the JU may apply the measures described in Chapter 6.

SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS

SUBSECTION 1 GENERAL

ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY

23a.1 Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities

Beneficiaries that are universities or other public research organisations must take measures to implement the principles set out in Points 1 and 2 of the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities¹⁹.

This does not change the obligations set out in Subsections 2 and 3 of this Section.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

23a.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND

ARTICLE 24 — AGREEMENT ON BACKGROUND

24.1 Agreement on background

The beneficiaries must identify and agree (in writing) on the background for the action (**‘agreement on background’**).

¹⁹ Commission Recommendation C(2008) 1329 of 10.4.2008 on the management of intellectual property in knowledge transfer activities and the Code of Practice for universities and other public research institutions attached to this recommendation.

‘Background’ means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that:

- (a) is held by the beneficiaries before they acceded to the Agreement, and
- (b) is needed to implement the action or exploit the results.

24.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND

25.1 Exercise of access rights — Waiving of access rights — No sub-licensing

To exercise access rights, this must first be requested in writing (**‘request for access’**).

‘Access rights’ means rights to use results or background under the terms and conditions laid down in this Agreement.

Waivers of access rights are not valid unless in writing.

Unless agreed otherwise, access rights do not include the right to sub-license.

25.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- (a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or
- (b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

25.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

‘Fair and reasonable conditions’ means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.4 Access rights for affiliated entities

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) — to affiliated entities²⁰ established in an EU Member State or ‘**associated country**’²¹, if this is needed to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.5 Access rights for third parties

Not applicable

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS

ARTICLE 26 — OWNERSHIP OF RESULTS

26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them.

‘**Results**’ means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

- (a) they have jointly generated them and

²⁰ For the definition, see ‘affiliated entity’ footnote (Article 14.1).

²¹ For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: ‘**associated country**’ means a third country which is party to an international agreement with the Union, as identified in Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.

(b) it is not possible to:

- (i) establish the respective contribution of each beneficiary, or
- (ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership (**‘joint ownership agreement’**), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

- (a) at least 45 days advance notice and
- (b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

26.3 Rights of third parties (including personnel)

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licences or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

26.4 JU ownership, to protect results

26.4.1 The JU may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to disseminate its results without protecting them, except in any of the following cases:

- (a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances);
- (b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or
- (c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

Before the results are disseminated and unless any of the cases above under Points (a), (b) or (c) applies, the beneficiary must formally notify the JU and at the same time inform it of any reasons for

refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the JU decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

No dissemination relating to these results may take place before the end of this period or, if the JU takes a positive decision, until it has taken the necessary steps to protect the results.

26.4.2 The JU may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

- (a) the protection is stopped because of a lack of potential for commercial or industrial exploitation;
- (b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the JU at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the JU decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

26.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to the any of the other measures described in Chapter 6.

ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS

27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

- (a) the results can reasonably be expected to be commercially or industrially exploited and
- (b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

27.2 JU ownership, to protect the results

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of

protection, the JU may — under certain conditions (see Article 26.4) — assume ownership to ensure their (continued) protection.

27.3 Information on JU funding and support from JU members

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the JU requests or agrees otherwise or unless it is impossible — include the following:

“The project leading to this application has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874477. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

27.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 28 — EXPLOITATION OF RESULTS

28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure ‘**exploitation**’ of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

- (a) using them in further research activities (outside the action);
- (b) developing, creating or marketing a product or process;
- (c) creating and providing a service, or
- (d) using them in standardisation activities.

This does not change the security obligations in Article 37, which still apply.

28.2 Results that could contribute to European or international standards — Information on JU funding and support from JU members

If results could reasonably be expected to contribute to European or international standards, the beneficiary concerned must — up to four years after the period set out in Article 3 — inform the JU.

If results are incorporated in a standard, the beneficiary concerned must — unless the JU requests or agrees otherwise or unless it is impossible — ask the standardisation body to include the following statement in (information related to) the standard:

“Results incorporated in this standard received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874477. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

28.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced in accordance with Article 43.

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS

29.1 Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — ‘**disseminate**’ its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the JU before dissemination takes place.

29.2 Open access to scientific publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

- (a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

- (b) ensure open access to the deposited publication — via the repository — at the latest:
 - (i) on publication, if an electronic version is available for free via the publisher, or
 - (ii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.

- (c) ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:

- the terms “SESAR Joint Undertaking”, “European Union (EU)” and “Horizon 2020”;
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

29.3 Open access to research data

Not applicable;

29.4 Information on JU funding and support from JU members — Obligation and right to use the JU logo and the EU emblem

Unless the JU requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

- (a) display the JU logo and
- (b) display the EU emblem and
- (c) include the following text:

“This project has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874477. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

When displayed together with another logo, the JU logo and the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the JU logo and the EU emblem without first obtaining approval from the JU or the Commission.

This does not however give them the right to exclusive use.

Moreover, they may not appropriate the JU logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.

29.5 Disclaimer excluding JU responsibility

Any dissemination of results must indicate that it reflects only the author's view and that the JU is not responsible for any use that may be made of the information it contains.

29.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS

30.1 Transfer of ownership

Each beneficiary may transfer ownership of its results.

It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.

This does not change the security obligations in Article 37, which still apply.

Unless agreed otherwise (in writing) for specifically-identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically-identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

30.2 Granting licenses

Each beneficiary may grant licences to its results (or otherwise give the right to exploit them), if:

- (a) this does not impede the access rights under Article 31 and
- (b) not applicable.

In addition to Points (a) and (b), exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights (see Article 31.1).

This does not change the dissemination obligations in Article 29 or security obligations in Article 37, which still apply.

30.3 JU right to object to transfers or exclusive licensing

The JU may — up to four years after the period set out in Article 3 — object to a transfer of ownership or the exclusive licensing of results, if:

- (a) it is to a third party established in a non-EU country not associated with Horizon 2020 and
- (b) the JU considers that the transfer or licence is not in line with EU interests regarding competitiveness or is inconsistent with ethical principles or security considerations.

A beneficiary that intends to transfer ownership or grant an exclusive licence must formally notify the JU before the intended transfer or licensing takes place and:

- identify the specific results concerned;
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU competitiveness and its consistency with ethical principles and security considerations.

The JU may request additional information.

If the JU decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the JU decision, within the period set out above;
- if the JU objects;
- until the conditions are complied with, if the JU objection comes with conditions.

30.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 31 — ACCESS RIGHTS TO RESULTS

31.1 Exercise of access rights — Waiving of access rights — No sub-licensing

The conditions set out in Article 25.1 apply.

The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

31.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

31.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other — under fair and reasonable conditions (see Article 25.3) — access to results needed for exploiting their own results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.4 Access rights of affiliated entities

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.5 Access rights for the JU, the EU institutions, other EU bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to the JU and to EU institutions, other EU bodies, offices or agencies, for developing, implementing or monitoring EU policies or programmes.

Such access rights are limited to non-commercial and non-competitive use.

This does not change the right to use any material, document or information received from the beneficiaries for communication and publicising activities (see Article 38.2).

31.6 Access rights for third parties

The beneficiaries must give — under the conditions set out in Article 31.2 — access to their results to complementary beneficiaries²² (see Article 2).

31.7 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SECTION 4 OTHER RIGHTS AND OBLIGATIONS

ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS

32.1 Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers²³, in particular regarding:

- working conditions;

²² ‘Complementary beneficiary’ means a beneficiary of a complementary grant agreement.

²³ Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

32.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

ARTICLE 33 — GENDER EQUALITY

33.1 Obligation to aim for gender equality

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

33.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

ARTICLE 34 — ETHICS AND RESEARCH INTEGRITY

34.1 Obligation to comply with ethical and research integrity principles

The beneficiaries must carry out the action in compliance with:

- (a) ethical principles (including the highest standards of research integrity)
- and
- (b) applicable international, EU and national law.

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States or for activities which destroy human embryos (for example, for obtaining stem cells).

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- (a) aim at human cloning for reproductive purposes;
- (b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or

- (c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity²⁴.

This implies compliance with the following fundamental principles:

- **reliability** in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources;
- **honesty** in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way;
- **respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment;
- **accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices and refrain from the research integrity violations described in this Code.

This does not change the other obligations under this Agreement or obligations under applicable international, EU or national law, all of which still apply.

34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the ‘**ethics requirements**’ set out as deliverables in Annex 1.

Before the beginning of an activity raising an ethical issue, each beneficiary must have obtained:

- (a) any ethics committee opinion required under national law and
- (b) any notification or authorisation for activities raising ethical issues required under national and/or European law

needed for implementing the action tasks in question.

The documents must be kept on file and be submitted upon request by the coordinator to the JU (see Article 52). If they are not in English, they must be submitted together with an English summary, which shows that the action tasks in question are covered and includes the conclusions of the committee or authority concerned (if available).

34.3 Activities involving human embryos or human embryonic stem cells

Activities involving research on human embryos or human embryonic stem cells may be carried out, in addition to Article 34.1, only if:

²⁴ European Code of Conduct for Research Integrity of ALLEA (All European Academies)
http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the JU (see Article 52).

34.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 35 — CONFLICT OF INTERESTS

35.1 Obligation to avoid a conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the action is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest (**‘conflict of interests’**).

They must formally notify to the JU without delay any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The JU may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

35.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 36 — CONFIDENTIALITY

36.1 General obligation to maintain confidentiality

During implementation of the action and for four years after the period set out in Article 3, the parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed (**‘confidential information’**).

If a beneficiary requests, the JU may agree to keep such information confidential for an additional period beyond the initial four years.

If information has been identified as confidential only orally, it will be considered to be confidential only if this is confirmed in writing within 15 days of the oral disclosure.

Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement.

The beneficiaries may disclose confidential information to their personnel or third parties involved in the action only if they:

- (a) need to know to implement the Agreement and
- (b) are bound by an obligation of confidentiality.

This does not change the security obligations in Article 37, which still apply.

The JU may disclose confidential information to its staff, other EU institutions and bodies. It may disclose confidential information to third parties, if:

- (a) this is necessary to implement the Agreement or safeguard the EU's or JU's financial interests and
- (b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

- (a) the disclosing party agrees to release the other party;
- (b) the information was already known by the recipient or is given to him without obligation of confidentiality by a third party that was not bound by any obligation of confidentiality;
- (c) the recipient proves that the information was developed without the use of confidential information;
- (d) the information becomes generally and publicly available, without breaching any confidentiality obligation, or
- (e) the disclosure of the information is required by EU or national law.

36.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 37 — SECURITY-RELATED OBLIGATIONS

37.1 Results with a security recommendation

Not applicable

37.2 Classified information

Not applicable

37.3 Activities involving dual-use goods or dangerous materials and substances

Not applicable

37.4 Consequences of non-compliance

Not applicable

ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS

38.1 Communication activities by beneficiaries

38.1.1 Obligation to promote the action and its results

The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the JU (see Article 52).

38.1.2 Information on JU funding and support from JU members — Obligation and right to use the JU logo and the EU emblem

Unless the JU requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

- (a) display the JU logo and
- (b) display the EU emblem and
- (c) include the following text:

For communication activities:

“This project has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874477. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

For infrastructure, equipment and major results:

“This *[infrastructure]**[equipment]**[insert type of result]* is part of a project that has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874477. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

When displayed together with another logo, the JU logo and the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the JU logo and the EU emblem without first obtaining approval from the JU or the Commission.

This does not, however, give them the right to exclusive use.

Moreover, they may not appropriate the JU logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.

38.1.3 Disclaimer excluding JU responsibility

Any communication activity related to the action must indicate that it reflects only the author's view and that the JU is not responsible for any use that may be made of the information it contains.

38.2 Communication activities by the JU

38.2.1 Right to use beneficiaries' materials, documents or information

The JU may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and public deliverables as well as any other material, such as pictures or audio-visual material received from any beneficiary (including in electronic form).

This does not change the confidentiality obligations in Article 36 and the security obligations in Article 37, all of which still apply.

If the JU's use of these materials, documents or information would risk compromising legitimate interests, the beneficiary concerned may request the JU not to use it (see Article 52).

The right to use a beneficiary's materials, documents and information includes:

- (a) **use for its own purposes** (in particular, making them available to persons working for the JU or any other EU institution, body, office or agency or body or institutions in EU Member States; and copying or reproducing them in whole or in part, in unlimited numbers);
- (b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes);
- (c) **editing or redrafting** for communication and publicising activities (including shortening, summarising, inserting other elements (such as meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation);
- (d) translation;
- (e) giving **access in response to individual requests** under Regulation No 1049/2001²⁷, without the right to reproduce or exploit;
- (f) **storage** in paper, electronic or other form;
- (g) **archiving**, in line with applicable document-management rules, and
- (h) the right to authorise **third parties** to act on its behalf or sub-license the modes of use set out in Points (b), (c), (d) and (f) to third parties if needed for the communication and publicising activities of the JU.

If the right of use is subject to rights of a third party (including personnel of the beneficiary), the beneficiary must ensure that it complies with its obligations under this Agreement (in particular, by obtaining the necessary approval from the third parties concerned).

²⁷ Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145, 31.5.2001, p. 43.

Where applicable (and if provided by the beneficiaries), the JU will insert the following information:

“© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the SESAR Joint Undertaking under conditions.”

38.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 39 — PROCESSING OF PERSONAL DATA

39.1 Processing of personal data by the JU and the Commission

Any personal data under the Agreement will be processed by the JU or the Commission under Regulation No 45/2001²⁸ and according to the ‘notifications of the processing operations’ to the Data Protection Officer (DPO) of the JU or the Commission (publicly accessible in the DPO register).

Such data will be processed by the ‘**data controller**’ of the JU or the Commission for the purposes of implementing, managing and monitoring the Agreement or protecting the financial interests of the JU, EU or Euratom (including checks, reviews, audits and investigations; see Article 22).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the ‘privacy statement’ that are published on the JU and the Commission websites.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS).

39.2 Processing of personal data by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The beneficiaries may grant their personnel access only to data that is strictly necessary for implementing, managing and monitoring the Agreement.

The beneficiaries must inform the personnel whose personal data are collected and processed by the JU or the Commission. For this purpose, they must provide them with the privacy statement(s) (see above), before transmitting their data to the JU or the Commission.

39.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 39.2, the JU may apply any of the measures described in Chapter 6.

²⁸ Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).

ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE JU

The beneficiaries may not assign any of their claims for payment against the JU to any third party, except if approved by the JU on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the JU has not accepted the assignment or the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the JU.

CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A JOINT ACTION

ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A JOINT ACTION

41.1 Roles and responsibility towards the JU

The beneficiaries have full responsibility for implementing the action and complying with the Agreement.

The beneficiaries are jointly and severally liable for the **technical implementation** of the action as described in Annex 1. If a beneficiary fails to implement its part of the action, the other beneficiaries become responsible for implementing this part (without being entitled to any additional JU funding for doing so), unless the JU expressly relieves them of this obligation.

The **financial responsibility** of each beneficiary is governed by Article 44.

41.2 Internal division of roles and responsibilities

The internal roles and responsibilities of the beneficiaries are divided as follows:

(a) Each **beneficiary** must:

- (i) keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system) up to date (see Article 17);
- (ii) inform the coordinator immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 17);
- (iii) submit to the coordinator in good time:
 - individual financial statements for itself and its linked third parties and, if required, certificates on the financial statements (see Article 20);
 - the data needed to draw up the technical reports (see Article 20);

- ethics committee opinions and notifications or authorisations for activities raising ethical issues (see Article 34);
- any other documents or information required by the JU under the Agreement, unless the Agreement requires the beneficiary to submit this information directly to the JU.

(b) The **coordinator** must:

- (i) monitor that the action is implemented properly (see Article 7);
- (ii) act as the intermediary for all communications between the beneficiaries and the JU (in particular, providing the JU with the information described in Article 17), unless the Agreement specifies otherwise;
- (iii) request and review any documents or information required by the JU and verify their completeness and correctness before passing them on to the JU;
- (iv) submit the deliverables and reports to the JU (see Articles 19 and 20);
- (v) ensure that all payments are made to the other beneficiaries without unjustified delay (see Article 21);
- (vi) inform the JU of the amounts paid to each beneficiary, when required under the Agreement (see Articles 44 and 50) or requested by the JU.

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including linked third parties).

41.3 Internal arrangements between beneficiaries — Consortium agreement

Not applicable

41.4 Relationship with complementary beneficiaries — Collaboration agreement

The beneficiaries must conclude a written ‘collaboration agreement’ with the complementary beneficiaries to coordinate the work under the Agreement and the complementary grant agreement(s) (see Article 2), covering for instance:

- efficient decision making processes and
- settlement of disputes.

The collaboration agreement must not contain any provision contrary to the Agreement.

The beneficiaries and complementary beneficiaries must create and participate in common boards and advisory structures to decide on collaboration and synchronisation of activities, including on management of outcomes, common approaches towards standardisation, SME involvement, links with regulatory and policy activities, and commonly shared dissemination and awareness raising activities.

The beneficiaries must give access to their results to the complementary beneficiaries, for the purposes of the complementary grant agreement(s) (see Article 31.6).

The beneficiaries must share the technical reports (see Article 20.3 and 20.4). The confidentiality obligations in Article 36 apply.

41.5 Relationship with partners of a joint action — Coordination agreement

Not applicable

CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE

SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS

ARTICLE 42 — REJECTION OF INELIGIBLE COSTS

42.1 Conditions

The JU will — after **termination of the participation of a beneficiary**, at the time of an **interim payment, at the payment of the balance or afterwards** — reject any costs which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 22).

The rejection may also be based on the **extension of findings from other grants to this grant** (see Article 22.5.2).

42.2 Ineligible costs to be rejected — Calculation — Procedure

Ineligible costs will be rejected in full.

If the rejection of costs does not lead to a recovery (see Article 44), the JU will formally notify the coordinator or beneficiary concerned of the rejection of costs, the amounts and the reasons why (if applicable, together with the notification of amounts due; see Article 21.5). The coordinator or beneficiary concerned may — within 30 days of receiving notification — formally notify the JU of its disagreement and the reasons why.

If the rejection of costs leads to a recovery, the JU will follow the contradictory procedure with pre-information letter set out in Article 44.

42.3 Effects

If the JU rejects costs at the time of an **interim payment or the payment of the balance**, it will deduct them from the total eligible costs declared, for the action, in the periodic or final summary financial statement (see Articles 20.3 and 20.4). It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the JU rejects costs **after termination of the participation of a beneficiary**, it will deduct them from the costs declared by the beneficiary in the termination report and include the rejection in the calculation after termination (see Article 50.2 and 50.3).

If the JU — **after an interim payment but before the payment of the balance** — rejects costs declared in a periodic summary financial statement, it will deduct them from the total eligible costs declared, for the action, in the next periodic summary financial statement or in the final summary financial statement. It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the JU rejects costs **after the payment of the balance**, it will deduct the amount rejected from the total eligible costs declared, by the beneficiary, in the final summary financial statement. It will then calculate the revised final grant amount as set out in Article 5.4.

ARTICLE 43 — REDUCTION OF THE GRANT

43.1 Conditions

The JU may — **after termination of the participation of a beneficiary, at the payment of the balance or afterwards** — reduce the grant amount (see Article 5.1), if :

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the seriousness of the errors, irregularities or fraud or breach of obligations.

Before reduction of the grant, the JU will formally notify a '**pre-information letter**' to the coordinator or beneficiary concerned:

- informing it of its intention to reduce the grant, the amount it intends to reduce and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the JU does not receive any observations or decides to pursue reduction despite the observations it has received, it will formally notify **confirmation** of the reduction (if applicable, together with the notification of amounts due; see Article 21).

43.3 Effects

If the JU reduces the grant **after termination of the participation of a beneficiary**, it will calculate

the reduced grant amount for that beneficiary and then determine the amount due to that beneficiary (see Article 50.2 and 50.3).

If the JU reduces the grant **at the payment of the balance**, it will calculate the reduced grant amount for the action and then determine the amount due as payment of the balance (see Articles 5.3.4 and 21.4).

If the JU reduces the grant **after the payment of the balance**, it will calculate the revised final grant amount for the beneficiary concerned (see Article 5.4). If the revised final grant amount for the beneficiary concerned is lower than its share of the final grant amount, the JU will recover the difference (see Article 44).

ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS

44.1 Amount to be recovered — Calculation — Procedure

The JU will — after **termination of the participation of a beneficiary, at the payment of the balance or afterwards** — claim back any amount that was paid, but is not due under the Agreement.

Each beneficiary's financial responsibility in case of recovery is limited to its own debt (including undue amounts paid by the JU for costs declared by its linked third parties), except for the amount retained for the Guarantee Fund (see Article 21.4).

44.1.1 Recovery after termination of a beneficiary's participation

If recovery takes place after termination of a beneficiary's participation (including the coordinator), the JU will claim back the undue amount from the beneficiary concerned, by formally notifying it a debit note (see Article 50.2 and 50.3). This note will specify the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the JU will **recover** the amount:

- (a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the JU.

In exceptional circumstances, to safeguard the EU's or JU's financial interests, the JU may offset before the payment date specified in the debit note;

- (b) not applicable;

- (c) by **taking legal action** (see Article 57).

If payment is not made by the date specified in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the JU receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC²⁹ applies.

44.1.2 Recovery at payment of the balance

If the payment of the balance takes the form of a recovery (see Article 21.4), the JU will formally notify a '**pre-information letter**' to the coordinator:

- informing it of its intention to recover, the amount due as the balance and the reasons why;
- specifying that it intends to deduct the amount to be recovered from the amount retained for the Guarantee Fund;
- requesting the coordinator to submit a report on the distribution of payments to the beneficiaries within 30 days of receiving notification, and
- inviting the coordinator to submit observations within 30 days of receiving notification.

If no observations are submitted or the JU decides to pursue recovery despite the observations it has received, it will **confirm recovery** (together with the notification of amounts due; see Article 21.5) and:

- pay the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is positive** or
- formally notify to the coordinator a **debit note** for the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is negative**. This note will also specify the terms and the date for payment.

If the coordinator does not repay the JU by the date in the debit note and has not submitted the report on the distribution of payments: the JU will **recover** the amount set out in the debit note from the coordinator (see below).

If the coordinator does not repay the JU by the date in the debit note, but has submitted the report on the distribution of payments: the JU will:

- (a) identify the beneficiaries for which the amount calculated as follows is negative:

{ { { (beneficiary's costs declared in the final summary financial statement and approved by the JU multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned

plus

its linked third parties' costs declared in the final summary financial statement and approved by the JU multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned}

divided by

the JU contribution for the action calculated according to Article 5.3.1}

multiplied by

²⁹ Directive 2007/64/EC of the European Parliament and of the Council of 13 November 2007 on payment services in the internal market amending Directives 97/7/EC, 2002/65/EC, 2005/60/EC and 2006/48/EC and repealing Directive 97/5/EC (OJ L 319, 05.12.2007, p. 1).

the final grant amount (see Article 5.3)},

minus

{pre-financing and interim payments received by the beneficiary}.

- (b) formally notify to each beneficiary identified according to point (a) a **debit note** specifying the terms and date for payment. The amount of the debit note is calculated as follows:

{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount set out in the debit note formally notified to the coordinator}.

If payment is not made by the date specified in the debit note, the JU will **recover** the amount:

- (a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the JU.

In exceptional circumstances, to safeguard the EU's or JU's financial interests, the JU may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The JU will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) not applicable;

(ii) by **taking legal action** (see Article 57).

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the JU receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

44.1.3 Recovery of amounts after payment of the balance

If, for a beneficiary, the revised final grant amount (see Article 5.4) is lower than its share of the final grant amount, it must repay the difference to the JU.

The beneficiary's share of the final grant amount is calculated as follows:

{{beneficiary's costs declared in the final summary financial statement and approved by the JU multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned

plus

its linked third parties' costs declared in the final summary financial statement and approved by the JU multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned}

divided by

the JU contribution for the action calculated according to Article 5.3.1}

multiplied by

the final grant amount (see Article 5.3)}.

If the coordinator has not distributed amounts received (see Article 21.7), the JU will also recover these amounts.

The JU will formally notify a **pre-information letter** to the beneficiary concerned:

- informing it of its intention to recover, the due amount and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If no observations are submitted or the JU decides to pursue recovery despite the observations it has received, it will **confirm** the amount to be recovered and formally notify to the beneficiary concerned a **debit note**. This note will also specify the terms and the date for payment.

If payment is not made by the date specified in the debit note, the JU will **recover** the amount:

- (a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the JU.

In exceptional circumstances, to safeguard the EU's or JU's financial interests, the JU may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The JU will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

- (i) not applicable;
- (ii) by **taking legal action** (see Article 57).

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the date for payment in the debit note, up to and including the date the JU receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

ARTICLE 45 — ADMINISTRATIVE SANCTIONS

In addition to contractual measures, the JU may also adopt administrative sanctions under Articles 84 and 89 of the JU Financial Rules read in conjunction with Articles 106 and 131(4) of the Financial

Regulation No 966/2012 (i.e. exclusion from future procurement contracts, grants, prizes and expert contracts and/or financial penalties).

SECTION 2 LIABILITY FOR DAMAGES

ARTICLE 46 — LIABILITY FOR DAMAGES

46.1 Liability of the JU

The JU cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of implementing the Agreement, including for gross negligence.

The JU cannot be held liable for any damage caused by any of the beneficiaries or third parties involved in the action, as a consequence of implementing the Agreement.

46.2 Liability of the beneficiaries

Except in case of force majeure (see Article 51), the beneficiaries must compensate the JU for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement.

SECTION 3 SUSPENSION AND TERMINATION

ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE

47.1 Conditions

The JU may — at any moment — suspend the payment deadline (see Article 21.2 to 21.4) if a request for payment (see Article 20) cannot be approved because:

- (a) it does not comply with the provisions of the Agreement (see Article 20);
- (b) the technical or financial reports have not been submitted or are not complete or additional information is needed, or
- (c) there is doubt about the eligibility of the costs declared in the financial statements and additional checks, reviews, audits or investigations are necessary.

47.2 Procedure

The JU will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day notification is sent by the JU (see Article 52).

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining period will resume.

If the suspension exceeds two months, the coordinator may request the JU if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the technical or financial reports (see Article 20) and the revised report or statement is not submitted or was submitted but is also rejected, the JU may also terminate the Agreement or the participation of the beneficiary (see Article 50.3.1(l)).

ARTICLE 48 — SUSPENSION OF PAYMENTS

48.1 Conditions

The JU may — at any moment — suspend payments, in whole or in part and for one or more beneficiaries, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed — in other JU, EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

If payments are suspended for one or more beneficiaries, the JU will make partial payment(s) for the part(s) not suspended. If suspension concerns the payment of the balance, — once suspension is lifted — the payment or the recovery of the amount(s) concerned will be considered the payment of the balance that closes the action.

48.2 Procedure

Before suspending payments, the JU will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend payments and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the JU does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the suspension procedure is not continued.

The suspension will **take effect** the day the confirmation notification is sent by the JU.

If the conditions for resuming payments are met, the suspension will be **lifted**. The JU will formally notify the coordinator or beneficiary concerned.

During the suspension, the periodic report(s) for all reporting periods except the last one (see Article 20.3), must not contain any individual financial statements from the beneficiary concerned and its linked third parties. The coordinator must include them in the next periodic report after the

suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

The beneficiaries may suspend implementation of the action (see Article 49.1) or terminate the Agreement or the participation of the beneficiary concerned (see Article 50.1 and 50.2).

ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION

49.1 Suspension of the action implementation, by the beneficiaries

49.1.1 Conditions

The beneficiaries may suspend implementation of the action or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 51) — make implementation impossible or excessively difficult.

49.1.2 Procedure

The coordinator must immediately formally notify to the JU the suspension (see Article 52), stating:

- the reasons why and
- the expected date of resumption.

The suspension will **take effect** the day this notification is received by the JU.

Once circumstances allow for implementation to resume, the coordinator must immediately formally notify the JU and request an **amendment** of the Agreement to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement or the participation of a beneficiary has been terminated (see Article 50).

The suspension will be **lifted** with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension of the action implementation are not eligible (see Article 6).

49.2 Suspension of the action implementation, by the JU

49.2.1 Conditions

The JU may suspend implementation of the action or any part of it, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (b) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf)

has committed — in other JU, EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2), or

(c) the action is suspected of having lost its scientific or technological relevance.

49.2.2 Procedure

Before suspending implementation of the action, the JU will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend the implementation and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the JU does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the procedure is not continued.

The suspension will **take effect** five days after confirmation notification is received (or on a later date specified in the notification).

It will be **lifted** if the conditions for resuming implementation of the action are met.

The coordinator or beneficiary concerned will be formally notified of the lifting and the Agreement will be **amended** to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement has already been terminated (see Article 50).

The suspension will be lifted with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension are not eligible (see Article 6).

The beneficiaries may not claim damages due to suspension by the JU (see Article 46).

Suspension of the action implementation does not affect the JU's right to terminate the Agreement or participation of a beneficiary (see Article 50), reduce the grant or recover amounts unduly paid (see Articles 43 and 44).

ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES

50.1 Termination of the Agreement, by the beneficiaries

50.1.1 Conditions and procedure

The beneficiaries may terminate the Agreement.

The coordinator must formally notify termination to the JU (see Article 52), stating:

- the reasons why and

- the date the termination will take effect. This date must be after the notification.

If no reasons are given or if the JU considers the reasons do not justify termination, the Agreement will be considered to have been ‘**terminated improperly**’.

The termination will **take effect** on the day specified in the notification.

50.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the open reporting period until termination; see Article 20.3) and
- (ii) the final report (see Article 20.4).

If the JU does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The JU will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Improper termination may lead to a reduction of the grant (see Article 43).

After termination, the beneficiaries’ obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

50.2 Termination of the participation of one or more beneficiaries, by the beneficiaries

50.2.1 Conditions and procedure

The participation of one or more beneficiaries may be terminated by the coordinator, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must formally notify termination to the JU (see Article 52) and inform the beneficiary concerned.

If the coordinator’s participation is terminated without its agreement, the formal notification must be done by another beneficiary (acting on behalf of the other beneficiaries).

The notification must include:

- the reasons why;
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing);
- the date the termination takes effect. This date must be after the notification, and
- a request for amendment (see Article 55), with a proposal for reallocation of the tasks and the estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination takes effect after the period set out in Article 3, no request for amendment must be included unless the beneficiary

concerned is the coordinator. In this case, the request for amendment must propose a new coordinator.

If this information is not given or if the JU considers that the reasons do not justify termination, the participation will be considered to have been **terminated improperly**.

The termination will **take effect** on the day specified in the notification.

50.2.2 Effects

The coordinator must — within 30 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned and
- (ii) if termination takes effect during the period set out in Article 3, a ‘**termination report**’ from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Articles 20.3 and 20.4).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the JU (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the JU, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The JU will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the JU.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the JU will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received **exceed the amounts due**:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The JU will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the JU will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the JU will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due and the JU will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
 - termination takes effect after an interim payment and
 - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the JU will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due. The JU will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the JU does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the JU does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

Improper termination may lead to a reduction of the grant (see Article 43) or termination of the Agreement (see Article 50).

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

50.3 Termination of the Agreement or the participation of one or more beneficiaries, by the JU

50.3.1 Conditions



The JU may terminate the Agreement or the participation of one or more beneficiaries, if:

- (a) one or more beneficiaries do not accede to the Agreement (see Article 56);
- (b) a change to their legal, financial, technical, organisational or ownership situation (or those of its linked third parties) is likely to substantially affect or delay the implementation of the action or calls into question the decision to award the grant;
- (c) following termination of participation for one or more beneficiaries (see above), the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants (see Article 55);
- (d) implementation of the action is prevented by force majeure (see Article 51) or suspended by the coordinator (see Article 49.1) and either:
 - (i) resumption is impossible, or
 - (ii) the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants;
- (e) a beneficiary is declared bankrupt, being wound up, having its affairs administered by the courts, has entered into an arrangement with creditors, has suspended business activities, or is subject to any other similar proceedings or procedures under national law;
- (f) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has been found guilty of professional misconduct, proven by any means;
- (g) a beneficiary does not comply with the applicable national law on taxes and social security;
- (h) the action has lost scientific or technological relevance;
- (i) not applicable;
- (j) not applicable;
- (k) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed fraud, corruption, or is involved in a criminal organisation, money laundering or any other illegal activity;
- (l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (m) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed — in other JU, EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2);

- (n) despite a specific request by the JU, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its linked third parties or international partners that is in one of the situations under points (e), (f), (g), (k), (l) or (m) and to reallocate its tasks.

50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the JU will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to terminate and the reasons why and
- inviting it, within 30 days of receiving notification, to submit observations and — in case of Point (l.ii) above — to inform the JU of the measures to ensure compliance with the obligations under the Agreement.

If the JU does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify to the coordinator or beneficiary concerned **confirmation** of the termination and the date it will take effect. Otherwise, it will formally notify that the procedure is not continued.

The termination will **take effect**:

- for terminations under Points (b), (c), (e), (g), (h), (j), (l.ii) and (n) above: on the day specified in the notification of the confirmation (see above);
- for terminations under Points (a), (d), (f), (i), (k), (l.i) and (m) above: on the day after the notification of the confirmation is received.

50.3.3 Effects

- (a) for **termination of the Agreement**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the last open reporting period until termination; see Article 20.3) and
- (ii) a final report (see Article 20.4).

If the Agreement is terminated for breach of the obligation to submit reports (see Articles 20.8 and 50.3.1(l)), the coordinator may not submit any reports after termination.

If the JU does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The JU will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

This does not affect the JU's right to reduce the grant (see Article 43) or to impose administrative sanctions (Article 45).

The beneficiaries may not claim damages due to termination by the JU (see Article 46).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

(b) for **termination of the participation of one or more beneficiaries**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned;
- (ii) a request for amendment (see Article 55), with a proposal for reallocation of the tasks and estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination is notified after the period set out in Article 3, no request for amendment must be submitted unless the beneficiary concerned is the coordinator. In this case the request for amendment must propose a new coordinator, and
- (iii) if termination takes effect during the period set out in Article 3, a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Article 20).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the JU (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the JU, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The JU will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the JU.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations



In case of a reduction (see Article 43), the JU will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received **exceed the amounts due**:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The JU will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the JU will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the JU will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due and the JU will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
 - termination takes effect after an interim payment and
 - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the JU will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due. The JU will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the JU does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the JU does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

SECTION 4 FORCE MAJEURE

ARTICLE 51 — FORCE MAJEURE

‘Force majeure’ means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties’ control,
- was not due to error or negligence on their part (or on the part of third parties involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

The following cannot be invoked as force majeure:

- any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure,
- labour disputes or strikes, or
- financial difficulties.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

The party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

CHAPTER 7 FINAL PROVISIONS

ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES

52.1 Form and means of communication

Communication under the Agreement (information, requests, submissions, ‘formal notifications’, etc.) must:

- be made in writing and
- bear the number of the Agreement.

All communication must be made through the Participant Portal **electronic** exchange system and using the forms and templates provided there.

If — after the payment of the balance — the JU finds that a formal notification was not accessed, a

second formal notification will be made by registered post with proof of delivery ('formal notification on **paper**'). Deadlines will be calculated from the moment of the second notification.

Communications in the electronic exchange system must be made by persons authorised according to the Participant Portal Terms & Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in his/her appointment letter (see Participant Portal Terms & Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the JU and Commission websites.

52.2 Date of communication

Communications are considered to have been made when they are sent by the sending party (i.e. on the date and time they are sent through the electronic exchange system).

Formal notifications through the **electronic** exchange system are considered to have been made when they are received by the receiving party (i.e. on the date and time of acceptance by the receiving party, as indicated by the time stamp). A formal notification that has not been accepted within 10 days after sending is considered to have been accepted.

Formal notifications **on paper** sent by **registered post** with proof of delivery (only after the payment of the balance) are considered to have been made on either:

- the delivery date registered by the postal service or
- the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

52.3 Addresses for communication

The **electronic** exchange system must be accessed via the following URL:

<https://ec.europa.eu/research/participants/portal/desktop/en/projects/>

The JU will formally notify the coordinator and beneficiaries in advance any changes to this URL.

Formal notifications on paper (only after the payment of the balance) addressed **to the JU** must be sent to the official mailing address indicated on the JU's website.

Formal notifications on paper (only after the payment of the balance) addressed **to the beneficiaries** must be sent to their legal address as specified in the Participant Portal Beneficiary Register.

ARTICLE 53 — INTERPRETATION OF THE AGREEMENT

53.1 Precedence of the Terms and Conditions over the Annexes

The provisions in the Terms and Conditions of the Agreement take precedence over its Annexes.

Annex 2 takes precedence over Annex 1.

53.2 Privileges and immunities

Nothing in the Agreement may be interpreted as a waiver of any privileges or immunities accorded to the *EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION* by its constituent documents or international law.

ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES

In accordance with Regulation No 1182/71³⁰, periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

ARTICLE 55 — AMENDMENTS TO THE AGREEMENT

55.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

55.2 Procedure

The party requesting an amendment must submit a request for amendment signed in the electronic exchange system (see Article 52).

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3).

If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why;
- the appropriate supporting documents, and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The JU may request additional information.

If the party receiving the request agrees, it must sign the amendment in the electronic exchange system within 45 days of receiving notification (or any additional information the JU has requested). If it

³⁰ Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8.6.1971, p. 1).

does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date agreed by the parties or, in the absence of such an agreement, on the date on which the amendment enters into force.

ARTICLE 56 — ACCESSION TO THE AGREEMENT

56.1 Accession of the beneficiaries mentioned in the Preamble

The other beneficiaries must accede to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52) within 30 days after its entry into force (see Article 58).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 58).

If a beneficiary does not accede to the Agreement within the above deadline, the coordinator must — within 30 days — request an amendment to make any changes necessary to ensure proper implementation of the action. This does not affect the JU's right to terminate the Agreement (see Article 50).

56.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 55. It must include an Accession Form (see Annex 3) signed by the new beneficiary in the electronic exchange system (see Article 52).

New beneficiaries must assume the rights and obligations under the Agreement with effect from the date of their accession specified in the Accession Form (see Annex 3).

ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

57.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

57.2 Dispute settlement

If a dispute concerning the interpretation, application or validity of the Agreement cannot be settled amicably, the General Court — or, on appeal, the Court of Justice of the European Union — has sole jurisdiction. Such actions must be brought under Article 272 of the Treaty on the Functioning of the EU (TFEU).

As an exception, if such a dispute is between the JU and SINTEF AS, AVINOR AS, FLUGHAFEN ZURICH AG, the competent Belgian courts have sole jurisdiction.

As an exception, for the following beneficiaries:

- EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION

such disputes must — if they cannot be settled amicably — be referred to arbitration. Each party must formally notify to the other party its intention of resorting to arbitration and the identity of the arbitrator. The Permanent Court of Arbitration Optional Rules for Arbitration Involving International Organisations and States in force at the date of entry into force of the Agreement will apply. The appointing authority will be the Secretary-General of the Permanent Court of Arbitration following a written request submitted by either party. The arbitration proceedings must take place in Brussels and the language used in the arbitral proceedings will be English. The arbitral award will be binding on all parties and will not be subject to appeal.

If a dispute concerns administrative sanctions or offsetting, the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 TFEU.

ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT

The Agreement will enter into force on the day of signature by the JU or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

For the JU



ANNEX 1 (part A)

Research and Innovation action

NUMBER — 874477 — PJ02-W2 AART

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1.1. The project summary

Project Number ¹	874477	Project Acronym ²	PJ02-W2 AART
One form per project			
General information			
Project title ³	Airport airside and runway throughput		
Starting date ⁴	01/12/2019		
Duration in months ⁵	37		
Call (part) identifier ⁶	H2020-SESAR-2019-1		
Topic	SESAR-IR-VLD-WAVE2-03-2019 PJ.02 W2 Airport airside and runway throughput		
Fixed EC Keywords			
Free keywords	GNSS TMA CDO curved approach runway throughput separation ROT secondary airports EFVS A-SMGCS Datalink surface management runway excursions		
Abstract ⁷			
<p>To improve the efficiency and resilience of arrival and departure operations at capacity constrained airports and access to secondary airports, the project will addresses human, technical, procedural and performance aspects of the following proposed improvements:</p> <ul style="list-style-type: none"> • Advanced geometric GNSS based procedures in the TMA The project will enhance TMA efficiency using more GNSS and advanced PBN curved for arrival and departure operations. Development of new support tools for ATC and airspace design concepts will enable greater usage of CDO. • Evolution of separation minima for increased runway throughput The project will refine separation minima as a function of the operational conditions. The most constraining minima (wake, runway occupancy,...) to be applied will be determined and ATCO support tool further developed for better separations delivery including separation delegation to the flight crew. • Improved access to secondary airports The project will enhance availability and accessibility of airports with limited infrastructure in low visibility conditions. Alternative Ground Surveillance will increase runway safety and will include both ATC and A-FIS requirements as a more cost-efficient and flexible ATS provision. From an airborne perspective, Enhanced Flight Vision System and Synthetic Vision Guidance System, Combined Vision System and LPV-100 capability will enable approach and landing. • Digital evolution of integrated surface management The extension of the A-SMGCS routing functions will improve tactical conflict management in the taxi phase. Optimised Routing and planning will deliver more accurate taxi times, improve predictability, minimize delays and ATCO's workload. Automation, A-CDM and Datalink will support conflict management. • Safety support tools for avoiding runway excursions The project will aim to detect, prevent and alert on risks of runway excursions by synchronising air-ground information exchange about runway surface condition. 			

1.2. List of Beneficiaries

Project Number ¹	874477	Project Acronym ²	PJ02-W2 AART
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List of Beneficiaries

No	Name	Short name	Country	Project entry month ⁸	Project exit month
1	EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION	EUROCONTROL	Belgium	1	37
2	AIRBUS	AIRBUS SAS	France	1	37
3	POLSKA AGENCJA ZEGLUGI POWIETRZNEJ	PANSA (B4)	Poland	1	37
4	LUFTFARTSVERKET	LFV/COOPANS	Sweden	1	37
5	DASSAULT AVIATION	DASSAULT	France	1	37
6	DFS DEUTSCHE FLUGSICHERUNG GMBH	DFS	Germany	1	37
7	ENAIRES	ENAIRES	Spain	1	37
8	ENAV SPA	ENAV	Italy	1	37
9	HUNGAROCNTRL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG	HC (FSP)	Hungary	1	37
10	HONEYWELL AEROSPACE	Honeywell SAS	France	1	37
11	INDRA SISTEMAS SA	INDRA	Spain	1	37
12	LEONARDO - SOCIETA PER AZIONI	LDO	Italy	1	37
13	SINTEF AS	SINTEF (NATMIG)	Norway	1	37
14	NATS (EN ROUTE) PUBLIC LIMITED COMPANY	NATS	United Kingdom	1	37
15	AVINOR AS	Avinor-SEAC2020	Norway	1	37
16	HEATHROW AIRPORT LIMITED	HAL (SEAC2020)	United Kingdom	1	37
17	SWEDAVIA AB	Swed (SEAC2020)	Sweden	1	37
18	THALES LAS FRANCE SAS	THALES AIR SYS	France	1	37
19	THALES AVS FRANCE SAS	THALES AVS	France	1	37
20	RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK	ANS CR (B4)	Czechia	1	37
21	LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK	LPS SR (B4)	Slovakia	1	37
22	VALSTYBES IMONE ORO NAVIGACIJA	ON (B4)	Lithuania	1	37
23	AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH	ACG/COOPANS	Austria	1	37
24	CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD	CCL/COOPANS	Croatia	1	37

1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry month ⁸	Project exit month
25	UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY	IAA/COOPANS	Ireland	1	37
26	NAVIAIR	Naviair/COOPANS	Denmark	1	37
27	ATOS BELGIUM	ATOS (FSP)	Belgium	1	37
28	FREQUENTIS AG	FRQ (FSP)	Austria	1	37
29	AIRTEL ATN LIMITED	AIRTEL (NATMIG)	Ireland	1	37
30	SAAB AKTIEBOLAG	SAAB (NATMIG)	Sweden	1	37
31	AEROPORTS DE PARIS SA	ADP (SEAC2020)	France	1	37
32	FLUGHAFEN MUNCHEN GMBH	MUC (SEAC2020)	Germany	1	37
33	SCHIPHOL NEDERLAND B.V.	SNBV (SEAC2020)	Netherlands	1	37
34	FLUGHAFEN ZURICH AG	ZRH (SEAC2020)	Switzerland	1	37

1.3. Workplan Tables - Detailed Implementation

Associated with document Ref. Ares(2019)7362963 - 29/11/2019

1.3.1. WT1 List of work packages

WP Number ⁹	WP Title	Lead beneficiary ¹⁰	Person-months ¹¹	Start month ¹²	End month ¹³
WP1	Ethics requirements	1 - EUROCONTROL	N/A	1	37
WP2	Project management	1 - EUROCONTROL	18.00	1	37
WP3	Solution 04: Advanced geometric GNSS based procedures in the TMA	17 - Swed (SEAC2020)	265.97	1	37
WP4	Solution 14 - Evolution of separation minima for increased runway throughput	1 - EUROCONTROL	750.87	1	37
WP5	Solution 17 - Improved access to secondary airports	10 - Honeywell SAS	748.18	1	37
WP6	Solution 21 - Digital evolution of integrated surface management	8 - ENAV	1,101.89	1	37
WP7	Solution 25 - Safety support tools for avoiding runway excursions	3 - PANSO (B4)	358.32	1	37
Total			3,243.23		

1.3.2. WT2 list of deliverables

Deliverable Number ¹⁴	Deliverable Title	WP number ⁹	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D1.1	GEN - Requirement No. 1	WP1	1 - EUROCONTROL	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D1.2	H - Requirement No. 2	WP1	1 - EUROCONTROL	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D1.3	POPD - Requirement No. 3	WP1	1 - EUROCONTROL	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D2.1	Project Management Plan	WP2	1 - EUROCONTROL	Report	Confidential, only for members of the consortium (including the Commission Services)	2
D2.2	Management Progress Report 2020	WP2	1 - EUROCONTROL	Report	Confidential, only for members of the consortium (including the Commission Services)	11
D2.3	Management Progress Report 2021	WP2	1 - EUROCONTROL	Report	Confidential, only for members of the consortium (including the Commission Services)	23
D2.4	Final Project Report	WP2	1 - EUROCONTROL	Report	Public	35
D3.1	Solution PJ.02-04: V2 Data Pack	WP3	17 - Swed (SEAC2020)	Report	Public	33
D4.1	Solution PJ.02-14: V2 Data Pack	WP4	1 - EUROCONTROL	Report	Public	33
D4.2	Solution PJ.02-14: V3 Data Pack	WP4	1 - EUROCONTROL	Report	Public	33
D5.1	Solution PJ.02-17: V3 Data Pack	WP5	10 - Honeywell SAS	Report	Public	33

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D6.1	Solution PJ.02-21: V3 Data Pack	WP6	8 - ENAV	Report	Public	33
D7.1	Solution PJ.02-25: V3 Data Pack	WP7	3 - PANSA (B4)	Report	Public	33

1.3.3. WT3 Work package descriptions

Work package number ⁹	WP1	Lead beneficiary ¹⁰	1 - EUROCONTROL
Work package title	Ethics requirements		
Start month	1	End month	37

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP1 - Ethics requirements [Months: 1-37]

EUROCONTROL

This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D1.1	GEN - Requirement No. 1	1 - EUROCONTROL	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D1.2	H - Requirement No. 2	1 - EUROCONTROL	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D1.3	POPD - Requirement No. 3	1 - EUROCONTROL	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D1.1 : GEN - Requirement No. 1 [3]

A thorough analysis and description of the ethics issues raised by this project and the measures that will be taken to ensure compliance with the ethics standards of H2020 must be included in the grant agreement before signature.

D1.2 : H - Requirement No. 2 [3]

2.1. The procedures and criteria that will be used to identify/recruit research participants must be submitted as a deliverable. 2.2. The informed consent procedures that will be implemented for the participation of humans must be submitted as a deliverable. 2.3. Templates of the informed consent/assent forms and information sheets (in language and terms intelligible to the participants) must be submitted as a deliverable.

D1.3 : POPD - Requirement No. 3 [3]

4.1 The beneficiary must confirm compliance with the General Data Protection Regulation (GDPR (EU) 2016/679) and with respective national legal framework(s). 4.2 The beneficiary must confirm that it has appointed a Data

Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. 4.4 The beneficiary must explain how all of the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimisation' principle). This must be submitted as a deliverable. 4.6 A description of the technical and organisational measures that will be implemented to safeguard the rights and freedoms of the data subjects/research participants must be submitted as a deliverable.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
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Work package number ⁹	WP2	Lead beneficiary ¹⁰	1 - EUROCONTROL
Work package title	Project management		
Start month	1	End month	37

Objectives

Coordination of technical activities and reporting

Description of work and role of partners

WP2 - Project management [Months: 1-37]

EUROCONTROL

- Project Management and Coordination (M1-M37):
 - o Day-to-day monitoring and control of project progress with respect to project objectives, timetable and acceptance of deliverables.
 - o Carry out main management activities at project level, reporting process and assure timely delivery. Organise meetings: annual SJU review meeting, PMB (monthly TelCo, on demand), EPMB (annual and on demand).
 - o The Project Manager (PM), together with the PMB and EPMB, will act as project steering committee.
 - o Change requests will be handled by the committee.
 - o A 6-monthly management report will document project progress.
 - o Coordinate the PCIT
- Project Quality Management and Standardisation (M1-M37):
 - o The coordinator will ensure the quality of the project. Project quality processes will be produced and those processes monitored.
- Reporting and Communication with the SJU (M1-M37):
 - o In cooperation with all involved partners, the POC for Communication Activities provide the required periodic and final reports to the SJU/EC.
- Technical and Scientific Coordination (M1-M37):
 - o The Project Content Integration Leader (PCIL) will organise the technical and scientific conceptualisation of the project, the coordination of technical activities in the project, and the development of a common project understanding and vision across the timeline. She coordinates the PCIT (Project Content Integration Team) activities.
- SESAR2020 Program Management (M1-M37):
 - o Participate in Programme Committee and sub-committees as agreed.
- Administration (M1-M37):
 - o Ensure that the EU Grant Agreement administration processes are deployed throughout the project and acted upon by partners as required.
- Communication (M1-M37):
 - o Working with partners, develop, coordinate and monitor the Project Communication Plan to the achieve project communication objectives in section 2.2 (b)

Participation per Partner

Partner number and short name	WP2 effort
1 - EUROCONTROL	18.00
Total	18.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D2.1	Project Management Plan	1 - EUROCONTROL	Report	Confidential, only for members of the consortium (including the Commission Services)	2
D2.2	Management Progress Report 2020	1 - EUROCONTROL	Report	Confidential, only for members of the consortium (including the Commission Services)	11
D2.3	Management Progress Report 2021	1 - EUROCONTROL	Report	Confidential, only for members of the consortium (including the Commission Services)	23
D2.4	Final Project Report	1 - EUROCONTROL	Report	Public	35

Description of deliverables

D.02.1.01 Project Management Plan T0 + 2 months
D.02.1.02 Management Progress Report October 2020
D.02.1.03 Management Progress Report October 2021
D.02.1.04 Final Project Report T0 + 35 months

D2.1 : Project Management Plan [2]

The Project Management Plan will further refine management processes in line with the governance rules defined in the Grant Agreement and in the SJU Membership Agreement.

D2.2 : Management Progress Report 2020 [11]

The Management Progress Report will provide insight of the project progress with the aim to assess the advancement of the programme as a whole.

D2.3 : Management Progress Report 2021 [23]

The Management Progress Report will provide insight of the project progress with the aim to assess the advancement of the programme as a whole.

D2.4 : Final Project Report [35]

The Final Project Report will summarise the achievements of the project, describe the potential further validation activities needed and map the results documented in various deliverables.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
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Work package number ⁹	WP3	Lead beneficiary ¹⁰	17 - Swed (SEAC2020)
Work package title	Solution 04: Advanced geometric GNSS based procedures in the TMA		
Start month	1	End month	37

Objectives

- Develop and validate concepts and systems covering the scope and objectives of SESAR Solution PJ.02-04 “Advanced geometric GNSS based procedures in the TMA”, addressing the following OI steps:
 - o AOM-0607 — Enhanced Terminal Area for Efficient Curved Operation
 - o AOM-0606 — Enhanced Parallel Approach Operations using PBN/RNP transitions to xLS
 - o AOM-0608 — Enhanced Parallel Approach Operations using PBN/RNP transitions to RNP (for at least one runway)
 - o AO-0313 — More flexible SID design by reducing divergence angle between independent departures
 - The objective is to achieve V2 maturity level at the end of Wave 2.
 - Produce the associated deliverables to this SESAR solution and prototypes.
 - In addition to the main deliverables, the solution will produce documentation permitting EASA and National regulation authorities, to take regulatory decisions supporting EU and local applicability
- The outcome of the WP will be packaged to describe ‘deployable’ and standalone solutions.

Description of work and role of partners

WP3 - Solution 04: Advanced geometric GNSS based procedures in the TMA [Months: 1-37]

Swed (SEAC2020), EUROCONTROL, LFV/COOPANS, INDRA, Avinor-SEAC2020, THALES AIR SYS, THALES AVS

T04.01 - PJ.02-04 Solution Management and Communication

- Lead Partner: Swed (SEAC2020)
- Contributors: LFV/COOPANS, EUROCONTROL, THALES AIR SYS, Avinor (SEAC2020), Thales Avionics, INDRA
- Coordinate partner and operational stakeholder’s participation, align solution processes with programme delivery processes, ensure coordination with Project Lead and PCIT prepare gates, Data pack and Deliverables preparation. Organise communication and dissemination activities. Support to EATMA modelling.

T04.02 - PJ.02-04 Concept Description (V2)

- Lead Partner: Swed (SEAC2020)
- Contributors: LFV/COOPANS, EUROCONTROL, THALES AIR SYS, Avinor (SEAC2020), Thales Avionics, INDRA
- Prepare the OSED/SPR/INTEROP as part of the V2 solution data pack and ensure regular update based on outcomes of validation threads for data pack delivery.

T04.03 - PJ.02-04 Technical Specification (V2)

- Lead Partner: LFV/COOPANS
- Contributors: THALES AIR SYS, EUROCONTROL, Swed (SEAC2020), Avinor (SEAC2020), Thales AVS, INDRA
- Prepare the TS/IRS as part of the V2 solution data pack, review and ensure regular update based on outcomes of validation threads for data pack delivery.

T04.04 - PJ.02-04 VALP (V2)

- Lead Partner: LFV/COOPANS
- Contributors: THALES AIR SYS, EUROCONTROL, Swed (SEAC2020), Avinor (SEAC2020), Thales Avionics, INDRA
- Structure and organise all validation threads of the solution. VALP deliverable will encompass reference to individual exercise plans.

T04.05 - PJ.02-04 Prototype Development (V2)

- Lead Partner: LFV/COOPANS
- Contributors: THALES AIR SYS, EUROCONTROL, Swed (SEAC2020), Avinor (SEAC2020), Thales Avionics
- Develop Ground ATC simulation Platform and prototypes to support all the validations
- Develop curved procedures to be flown, navigation database management, simulation recording capabilities, platform based on operational requirements to support Exercise 2. This includes pre-validation of the platform
- Develop Ground simulation Platform to support the FTS validations

T04.06.01 - PJ.02-04 Exercise 1 – Real Time Simulation of ground aspects and ATCO support for curved TMA operations (V2) – (AOM-0606, AOM-0607, AOM-0608)

- Lead Partner: LFV/COOPANS
- Contributors: THALES AIR SYS, Swed (SEAC2020),
- Assess the operational aspects of a ATCO system support tool to enable mixed mode operation in the arrival phase, i.e. mixing curved and straight-in approaches
- Assess operational acceptability and feasibility of curved operation in the TMA, including 'RNP to xLS' procedures with transition from barometric to geometric altitude using GNSS
- Analyse safety and humans performance aspects of the initial and intermediate approach phases and the use of RF leg in the departure phase in a mixed mode environment
- T04.06. 02 - PJ.02-04 Exercise 2 - Real Time Simulation of curved operation aspects in cockpit (V2) – (AO-0313, AOM-0606, AOM-0607, AOM-0608)
- Lead Partner: EUROCONTROL
- Contributors: Swed (SEAC2020), Avinor (SEAC2020), LFV/COOPANS
- Assess optimisation of curved operations using GNSS vertical navigation in the TMA in all meteorological conditions
- Study the aspects of the transition from barometric to GNSS based vertical navigation
- Assess vertical performance of barometric versus geometric (steep) final approach procedures (this may be supplemented by data analysis)
- Assess the use of RF leg(s) during the departure phase, including meteorological and operational aspects, for example use of different turn radii immediately after departure
- Address Human Performance, Safety, Environment sustainability and fuel efficiency KPAs based on lessons learned during the V1 validation exercise
- Liaison activities with ICAO IFPC
- T04.06.03 - PJ.02-04 Exercise 3 - Fast Time Simulation of ground aspects related to curved TMA operations (V2) - (AO-0313, AOM-0606, AOM-0607, AOM-0608)
- Lead Partner: Swed (SEAC2020)
- Contributors: LFV/COOPANS, Avinor (SEAC2020)
- Use simulation software capable of modelling aircraft flows to study flow interaction and overall impact at airport level. Special consideration of mixed mode operation.
- T04.06.04 - PJ.02-04 Exercise 4 – Real Time Simulation of airborne aspects related to curved TMA operations (V2) - (AOM-0606, AOM-0607, AOM-0608)
- Lead Partner: Thales Avionics
- Contributor: Swed (SEAC2020), Avinor (SEAC2020), EUROCONTROL
- Use prototype FMS implementing vertical transition from barometric VNAV to geometric NAV to allow RTS simulation of a curved TMA operation in avionics simulation bench enabling real time flight simulation.
- T04.07 - PJ.02-04 Validation Report (V2)
- Lead Partner: LFV/COOPANS
- Contributors: THALES AIR SYS, Swed (SEAC2020), EUROCONTROL, Avinor (SEAC2020), Thales Avionics, INDRA
- Structure and organise all outcomes of the validation threads of the solution. VALR deliverable will encompass reference to Safety and HP cases for V2 Maturity Level.
- T04.08 - PJ.02-04 CBA (V2)
- Lead Partner: Swed (SEAC2020)
- Contributors: LFV/COOPANS, EUROCONTROL
- Prepare the CBA as part of the V2 solution data pack. Cost benefit analyses will be based on outcomes from solution thread and/or internal activities to the task.

Participation per Partner

Partner number and short name	WP3 effort
1 - EUROCONTROL	21.60
4 - LFV/COOPANS	43.44
11 - INDRA	0.80
INDRA NAVIA	8.42
15 - Avinor-SEAC2020	4.00

Partner number and short name	WP3 effort
17 - Swed (SEAC2020)	13.00
18 - THALES AIR SYS	144.00
19 - THALES AVS	30.71
Total	265.97

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D3.1	Solution PJ.02-04: V2 Data Pack	17 - Swed (SEAC2020)	Report	Public	33

Description of deliverables

D3.1 Solution PJ.02-04: V2 Data Pack T0 + 33 months
D3.1 : Solution PJ.02-04: V2 Data Pack [33]
Data pack for the solution including ValR, OSED/SPR/Interop, TS/IRS, CBA, ValP for next maturity level...

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	V2 Gate for solution PJ.02-04	17 - Swed (SEAC2020)	36	

Work package number ⁹	WP4	Lead beneficiary ¹⁰	1 - EUROCONTROL
Work package title	Solution 14 - Evolution of separation minima for increased runway throughput		
Start month	1	End month	37

Objectives

- Develop and validate concepts and systems covering the scope and objectives of SESAR Solution PJ.02-14 “Evolution of separation minima for increased runway throughput”, addressing the following OI steps:
 - o AO-0334 and AO-0315: Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival and departure
 - o AO-0335: Dynamic Pairwise Runway Separations for Arrivals (based on ground information)
 - o AO-0336: Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange)
 - o AO-0308, AO-0319, AO-0320, AO-0321, AO-0331: Enhanced Approach Procedures
 - o AO-0306 and AO-0323: Static Pairwise Separations for Arrivals and Departures
 - o AO-0307 and AO-0324: Dynamic Pairwise Wake Separations for Arrivals for Arrival and Departure
 - o AUO-0504: Delegation of Dynamic Separation to the Aircraft
 - Produce the associated deliverables to this SESAR solution and prototypes
 - In addition to the main deliverables, the solution will produce documentation permitting EASA and National regulation authorities, to take regulatory decisions supporting EU and local applicability
- The outcome of the WP will be packaged to describe ‘deployable’ and standalone solutions.

Description of work and role of partners

WP4 - Solution 14 - Evolution of separation minima for increased runway throughput [Months: 1-37]
EUROCONTROL, AIRBUS SAS, ENAIRE, LDO, SINTEF (NATMIG), NATS, HAL (SEAC2020)

T14.01 - PJ.02-14 Solution Management and Communication

- Lead Partner: EUROCONTROL
- Contributors: NATS, SINTEF (NATMIG), LDO
- Coordinate partner and operational stakeholder’s participation, align solution processes with programme delivery processes (PJ19), ensure coordination with Project Lead and PCIT prepare gates, Data pack and Deliverables preparation. Organise communication activities. Support to EATMA modelling.

T14.02.01 - PJ.02-14 Concept Description (V2)

- Lead Partner: EUROCONTROL
- Contributors: NATS, SINTEF (NATMIG), ENAIRE, HAL
- Prepare the OSIED/SPR/INTEROP as part of the V2 solution data pack and ensure regular update based on outcomes of validation threads for data pack delivery.

T14.02.02 - PJ.02-14 Concept Description (V3)

- Lead Partner: EUROCONTROL
- Contributors: NATS
- Prepare the OSIED/SPR/INTEROP as part of the V3 solution data pack and ensure regular update based on outcomes of validation threads for data pack delivery.

T14.03.01 - PJ.02-14 Technical Specification (V2)

- Lead Partner: EUROCONTROL
- Contributors: NATS, LDO
- Prepare the TS/IRS as part of the V2 solution data pack, review and ensure regular update based on outcomes of validation threads for data pack delivery.

T14.03.02 - PJ.02-14 Technical Specification (V3)

- Lead Partner: EUROCONTROL
- Contributors: NATS
- Prepare the TS/IRS as part of the V3 solution data pack, review and ensure regular update based on outcomes of validation threads for data pack delivery.

T14.04.1 - PJ.02-14 VALP (V2)

- Lead Partner: EUROCONTROL
- Contributors: NATS, AIRBUS, LDO
- Structure and organise all validation V2 threads of the solution. VALP deliverable will encompass reference to individual exercise plans.

T14.04.02 - PJ.02-14 VALP (V3)

- Lead Partner: EUROCONTROL
- Contributors: NATS
- Structure and organise all validation V3 threads of the solution. VALP deliverable will encompass reference to individual exercise plans.

T14.05.01 - PJ.02-14 Prototype Development (V2)

- Lead Partner: EUROCONTROL
- Contributors: AIRBUS, LDO
- Develop Industry Based Platform and prototypes to support the V2 validation Exercises

T14.05.02 - PJ.02-14 Prototype Development (V3)

- Lead Partner: EUROCONTROL
- Contributors: -
- Develop Industry Based Platform and prototypes to support the V3 validation Exercises

T14.06.1 - PJ.02-14 Exercise 1 – Real Time Simulation of Enhanced Approach Procedures 1 (V3) - (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)

- Lead Partner: EUROCONTROL
- Contributors: -
- V3 validation of EAP using separation delivery tool for dealing with complex separation rules, monitoring of aircraft trajectories, single or multiple interception altitudes.

T14.06.2 - PJ.02-14 Exercise 2 – Real Time Simulation of Enhanced Approach Procedures 2 (V3) - (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)

- Lead Partner: EUROCONTROL
- Contributors: -
- V3 validation of EAP using separation delivery tool for dealing with complex separation rules, monitoring of aircraft trajectories, single or multiple interception altitudes.

T14.06.3 - PJ.02-14 Exercise 3 – Live Trial of Dynamic Wake Separation for Arrival and Departure (V2) - (AO-0307, AO-0324)

- Lead Partner: EUROCONTROL
- Contributors: -
- Real-time measurement of wake behaviour of already landed aircraft used for defining separation of the approaching pair. The exercise will validate the real-time feasibility of this computation and the suitability of the buffer taken according to wake behaviour measure once the approaching aircraft landed.

T14.06.4 - PJ.02-14 Exercise 4 – Live Trial of Dynamic Runway Separations 1 (V2) – (AO-0335)

- Lead Partner: EUROCONTROL
- Contributors: -
- Real-time use of several features like wind, aircraft type, airline, runway condition for predicting runway occupancy time of approaching aircraft. The exercise will validate the real-time feasibility of this computation and the suitability of the buffer taken according to ROT measure once the approaching aircraft landed.

T14.06.5 - PJ.02-14 Exercise 5 – Live Trial of Dynamic Runway Separations 2 (V2) – (AO-0335)

- Lead Partner: EUROCONTROL
- Contributors: -
- Real-time use of several features like wind, aircraft type, airline, runway condition for predicting runway occupancy time of approaching aircraft. The exercise will validate the real-time feasibility of this computation and the suitability of the buffer taken according to ROT measure once the approaching aircraft landed.

T14.06.6 - PJ.02-14 Exercise 6 – Fast Time Simulation of supporting V2 validation (V2) - (AO-0307, AO-0315, AO-0324, AO-0332, AO-0334, AO-0335)

- Lead Partner: EUROCONTROL
- Contributors: -
- Fast time simulation will be used for supporting performance assessment of all V2 validations

T14.06.7 - PJ.02-14 Exercise 7 – Fast Time Simulation of supporting V3 validation (V3) - (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)

- Lead Partner: EUROCONTROL
- Contributors: -
- Fast time simulation will be used for supporting performance assessment of all V3 validations

T14.06.8 - PJ.02-14 Exercise 8 – Back-to-back simulations based on in-service data and Airbus aircraft performance models supporting Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (V2) – (AO-0336)

- Lead Partner: AIRBUS
- Contributors: -

- The simulations will consist mostly in analysing in-service data and computing the expected ROT computed with the newly developed ROT-calculator, under the same conditions (aircraft weight, temperature, altitude, runway exit, braking strategy, etc). Comparison between the calculated (or predicted) ROT and the actual one will then be done for each flight
T14.06.9 - PJ.02-14 Exercise 9 – Airtop Fast time Simulation of supporting Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (V2) – (AO-0336)
- Lead Partner: AIRBUS
- Contributors: -
- Fast time simulation will be used for supporting performance assessment
T14.06.10 - PJ.02-14 Exercise 10 – Flight Simulation supporting Enhanced Approach Procedures (V3) - (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)
- Lead Partner: EUROCONTROL
- Contributors: -
- Flight simulation supporting definition of runway lighting for displaced threshold and increase glide slope
T14.06.11 - PJ.02-14 Exercise 11 – Flight Simulation supporting PWS-D (V3) - (AO-0306, AO-0323)
- Lead Partner: EUROCONTROL
- Contributors: NATS, HAL
- Flight simulation supporting refinement of static PWS for departure
T14.06.12 - PJ.02-14 Exercise 12 – Real Time Simulation supporting Delegation of Dynamic Separation to the Aircraft (V2) – (AUO-0504)
- Lead Partner: AIRBUS
- Contributors: -
- Real time simulation supporting Delegation of Dynamic Separation to the Aircraft
T14.06.13 - PJ.02-14 Exercise 13 – Technical Validation of SWIM Wind Conditions Service and Underlying Capabilities for Wake Turbulence Separation (METForWTS) (V2) - (AO-0315, AO-0332, AO-0334)
- Lead Partner: LDO
- Contributors: NATS
- Special requirements for tailor made wind products in the arrival and departure path will be implemented in a dedicated SWIM service that supports the different concepts for A/C sequences. Additionally, it shall be evaluated, what benefit for short term nowcasting of wind in the arrival and departure path follows from techniques that e.g. make use of measurements of the upstream wind (Doppler Lidar, Doppler Radar).
T14.07.01 - PJ.02-14 Validation Report (V2)
- Lead Partner: EUROCONTROL
- Contributors: NATS, AIRBUS
- Structure and organise all outcomes of the validation threads of the solution. VALR deliverable will encompass reference to Safety and HP cases for V2 Maturity Level.
T14.07.02 - PJ.02-14 Validation Report (V3)
- Lead Partner: EUROCONTROL
- Contributors: NATS
- Structure and organise all outcomes of the validation threads of the solution. VALR deliverable will encompass reference to Safety and HP cases for V3 Maturity Level.
T14.08.01 - PJ.02-14 CBA (V2)
- Lead Partner: EUROCONTROL
- Contributors: NATS, AIRBUS
- Prepare the CBA as part of the V2 solution data pack. Cost benefit analyses will be based on outcomes from solution thread and/or internal activities to the task.
T14.08.01 - PJ.02-14 CBA (V3)
- Lead Partner: EUROCONTROL
- Contributors: AIRBUS, NATS, HAL
- Prepare the CBA as part of the V3 solution data pack. Cost benefit analyses will be based on outcomes from solution thread and/or internal activities to the task.

Participation per Partner

Partner number and short name	WP4 effort
1 - EUROCONTROL	514.60

Partner number and short name	WP4 effort
2 - AIRBUS SAS	28.88
AI OP SAS	87.01
7 - ENAIRE	8.46
CRIDA	9.02
12 - LDO	20.32
LDO GMBH	13.85
TPZ	11.33
13 - SINTEF (NATMIG)	15.00
14 - NATS	39.40
16 - HAL (SEAC2020)	3.00
Total	750.87

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D4.1	Solution PJ.02-14: V2 Data Pack	1 - EUROCONTROL	Report	Public	33
D4.2	Solution PJ.02-14: V3 Data Pack	1 - EUROCONTROL	Report	Public	33

Description of deliverables

D.4.1 Solution PJ.02-14: V2 Data Pack T0 + 33 months
D.4.2 Solution PJ.02-14: V3 Data Pack T0 + 33 months
D4.1 : Solution PJ.02-14: V2 Data Pack [33]
Data pack for the solution including ValR, OSED/SPR/Interop, TS/IRS, CBA, ValP for next maturity level...
D4.2 : Solution PJ.02-14: V3 Data Pack [33]
Data pack for the solution including ValR, OSED/SPR/Interop, TS/IRS, CBA...

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS2	V2 Gate for solution PJ.02-14	1 - EUROCONTROL	36	
MS3	V3 Gate for solution PJ.02-14	1 - EUROCONTROL	36	

Work package number ⁹	WP5	Lead beneficiary ¹⁰	10 - Honeywell SAS
Work package title	Solution 17 - Improved access to secondary airports		
Start month	1	End month	37

Objectives

- Develop and validate concepts and systems covering the scope and objectives of SESAR Solution PJ.02-17 “Improved access to secondary airports”, addressing the following OI Steps:
 - o SDM-0301: Improved access into small airports in low visibility conditions
 - o AO-0108: Airport Safety Nets for Controllers at Secondary Airports
 - o AO-0333: Improved Approach procedures into Secondary Airports in Low Visibility Conditions
 - o AUO-0410: Equivalent Visual Approach and Landing operations providing improved resilience to LVC
 - The objective is to achieve a full V3 maturity level at the end of Wave 2.
 - Produce the associated deliverables to this SESAR solution and prototypes
 - In addition to the main deliverables, the solution will produce documentation permitting EASA and National regulation authorities, to take regulatory decisions supporting EU and local applicability
- The outcome of the WP will be packaged to describe ‘deployable’ and standalone solutions.

Description of work and role of partners

WP5 - Solution 17 - Improved access to secondary airports [Months: 1-37]

Honeywell SAS, EUROCONTROL, AIRBUS SAS, PANSA (B4), DASSAULT, ENAIRE, THALES AIR SYS, THALES AVS

T17.0.01 - PJ.02-17 Solution Management and Communication

- Lead Partner: HONEYWELL
- Contributors: AIRBUS, PANSA (B4), DASSAULT, ENAIRE, THALES AIR SYS, THALES Avionics
- Coordinate partner and operational stakeholder’s participation, align solution processes with programme delivery processes (PJ19), ensure coordination with Project Lead and PCIT prepare gates, Data pack and Deliverables preparation. Organise communication activities. Support to EATMA modelling.

T17.3.02 - PJ.02-17 Concept Description (V3)

- Lead Partner: PANSA (B4)
- Contributors: AIRBUS, DASSAULT, ENAIRE, HONEYWELL, THALES AIR SYS, THALES Avionics
- Prepare the OSIED/SPR/INTEROP as part of the V3 solution data pack and ensure regular update based on outcomes of validation threads for data pack delivery.

T17.3.03 - PJ.02-17 Technical Specification (V3)

- Lead Partner: THALES AIR SYS
- Contributors: AIRBUS, PANSA (B4), DASSAULT, ENAIRE, HONEYWELL, THALES Avionics
- Prepare the TS/IRS as part of the V3 solution data pack, review and ensure regular update based on outcomes of validation threads for data pack delivery.

T17.3.04 - PJ.02-17 VALP (V3)

- Lead Partner: THALES Avionics
- Contributors: AIRBUS, PANSA (B4), DASSAULT, ENAIRE, EUROCONTROL, HONEYWELL, THALES AIR SYS
- Structure and organize all validation threads of the solution. VALP deliverable will encompass reference to individual exercise plans.

T17.3.05 - PJ.02-17 Prototype Development (V3)

- Lead Partner: HONEYWELL
- Contributors: AIRBUS, PANSA (B4), DASSAULT, ENAIRE, THALES AIR SYS, THALES Avionics
- Develop Industry Based Platform and prototypes to support the validation

T17.3.06.1 - PJ.02-17 Exercise 1 – Real Time Simulation of Alternative Ground Surveillance using camera tracking and safety nets (V3) – (AO-0108, SDM-0301)

- Lead Partner: PANSA (B4)
- Contributors: THALES AIR SYS
- SHADOW MODE or LIVE trials for Alternative Ground Surveillance including Safety Nets

T17.3.06.2 - PJ.02-17 Exercise 2 – Live Trials of Alternative Ground Surveillance using air sensors (V3) – (AO-0108, SDM-0301)

- Lead Partner: THALES AIR SYS
- Contributors: N/A
- RTS or SHADOW MODE Alternative Ground Surveillance using air sensors including Safety Nets
T17.3.06.3 - PJ.02-17 Exercise 3 – Fast Time Simulation of LPV-100 approach capability (V3) – (AO-0333)
- Lead Partner: HONEYWELL
- Contributors: N/A
- Fast Time Simulation for LPV-100 approach operation
T17.3.06.4 - PJ.02-17 Exercise 4 – Live Trials of LPV-100 approach capability (V3) – (AO-0333)
- Lead Partner: HONEYWELL
- Contributors: N/A
- Live Trials Simulation for LPV-100 approach operation
T17.3.06.5 - PJ.02-17 Exercise 5 – Real Time Simulation for Combined Vision using active sensor (V3) – (AUO-0410)
- Lead Partner: HONEYWELL
- Contributors: DASSAULT
- Real Time Simulation for Equivalent Visual Approach with CVS using active sensor
T17.3.06.6 - PJ.02-17 Exercise 6 – Real Time Simulation Simulation evaluation for SVGS in HUD for CVS (V2) – (AUO-0410)
- Lead Partner: DASSAULT
- Contributors: HONEYWELL
- Real Time Simulation for SVGS on HUD for CVS
T17.3.06.7 - PJ.02-17 Exercise 7 – Evaluation of CVS image using active sensor (based on simulation tool outputs) (V2) – (AUO-0410)
- Lead Partner: DASSAULT
- Contributors: HONEYWELL
- Pilots evaluation based on Simulation tools output of CVS image using active sensor
T17.3.06.8 - PJ.02-17 Exercise 8 – Live Trials of Combined Vision using active sensor (V3) – (AUO-0410)
- Lead Partner: HONEYWELL
- Contributors: DASSAULT
- Live Trials for Equivalent Visual Approach with CVS using active sensor
T17.3.06.9 - PJ.02-17 Exercise 9 – Fast Time Simulation of SVGS on LPV approaches simulations (V1) – (AUO-0410)
- Lead Partner: THALES Avionics
- Contributors: N/A
- Fast Time simulations for validation of SVGS procedures based on LPV approaches
T17.3.06.10 - PJ.02-17 Exercise 10 – Live Flights test Trials for EFVS on LPV approaches (V3) – (AUO-0410)
- Lead Partner: AIRBUS
- Contributors: N/A
- Flight test with test aircraft equipped with EFVS for LVP approaches
T17.3.07 - PJ.02-17 Validation Report (V3)
- Lead Partner: DASSAULT
- Contributors: AIRBUS, PANSA (B4), ENAIRE, HONEYWELL, THALES AIR SYS, THALES Avionics
- Structure and organise all outcomes of the validation threads of the solution. VALR deliverable will encompass reference to Safety and HP cases for V3 Maturity Level.
T14.3.08 - PJ.02-17 CBA (V3)
- Lead Partner: AIRBUS
- Contributors: PANSA (B4), DASSAULT, ENAIRE, HONEYWELL, THALES Avionics
- Prepare the CBA as part of the V3 solution data pack. Cost benefit analyses will be based on outcomes from solution thread and/or internal activities to the task.

Participation per Partner

Partner number and short name	WP5 effort
1 - EUROCONTROL	7.50
2 - AIRBUS SAS	4.75
AI OP SAS	81.02

Partner number and short name	WP5 effort
3 - PANSa (B4)	31.12
WASKO S.A.	73.43
5 - DASSAULT	26.30
7 - ENAIRE	4.10
10 - Honeywell SAS	268.75
18 - THALES AIR SYS	0.01
SEARIDGE	3.59
NAV PORTUGAL	14.01
EDISOFT	127.94
19 - THALES AVS	105.66
Total	748.18

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D5.1	Solution PJ.02-17: V3 Data Pack	10 - Honeywell SAS	Report	Public	33

Description of deliverables

D.5.1 Solution PJ.02-17: V3 Data Pack T0 + 33 months
D5.1 : Solution PJ.02-17: V3 Data Pack [33]
Data pack for the solution including ValR, OSED/SPR/Interop, TS/IRS, CBA...

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS4	V3 Gate for solution PJ.02-17	10 - Honeywell SAS	36	

Work package number ⁹	WP6	Lead beneficiary ¹⁰	8 - ENAV
Work package title	Solution 21 - Digital evolution of integrated surface management		
Start month	1	End month	37

Objectives

- Develop and validate concepts and systems covering the scope and objectives of SESAR Solution PJ.02-21 “Digital evolution of integrated surface management”, addressing the following OI Steps:
 - o AO-0206: Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing
 - o AO-0215: Airport ATC provision of ground-related clearances and information to vehicle drivers via datalink
 - o AO-0222-B: Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways)
 - o AO-0223-B: Enhanced Safety in LVP through use of Dynamic Virtual Block Control
 - o AO-0224: Advanced Automated Assistance to Controller for Surface Movement Planning and Routing
 - o AUO-0308-B: Datalink Services used for Provision of Ground-related Clearances and Information for Step 2
 - o AUO-0603-B: Enhanced Guidance Assistance to Aircraft on the Airport Surface Combined with Routing in Step 2
 - o AO-0104-B: Extended Safety Nets for Controllers at A-SMGCS Airports
 - The objective is to achieve a full V3 maturity level at the end of Wave 2.
 - Produce the associated deliverables to this SESAR solution and prototypes
 - In addition to the main deliverables, the solution will produce documentation permitting EASA and National regulation authorities, to take regulatory decisions supporting EU and local applicability
- The outcome of the WP will be packaged to describe ‘deployable’ and standalone solutions.

Description of work and role of partners

WP6 - Solution 21 - Digital evolution of integrated surface management [Months: 1-37]
ENAV, DFS, ENAIRE, HC (FSP), INDRA, LDO, THALES AIR SYS
 T21.01 - PJ.02-21 Solution Management and Communication
 • Lead Partner: ENAV
 • Contributors: DFS, ENAIRE, INDRA, LDO, THALES AIR SYS
 • Coordinate partner and operational stakeholder’s participation, align solution processes with programme delivery processes (PJ19), ensure coordination with Project Lead and PCIT, prepare gates, Deliverables and Data pack. Support to EATMA modelling. Organise communication activities.
 T21.02 - PJ.02-21 Concept Description (V3)
 • Lead Partner: ENAV
 • Contributors: ENAIRE, DFS, INDRA, LDO, THALES AIR SYS
 • Prepare the OSIED/SPR/INTEROP as part of the V3 solution data pack and ensure regular update based on outcomes of validation threads for data pack delivery.
 T21.03 - PJ.02-21 Technical Specification (V3)
 • Lead Partner: INDRA / DFS
 • Contributors: ENAV, ENAIRE, LDO, THALES AIR SYS
 • Prepare the TS/IRS as part of the V3 solution data pack, review and ensure regular update based on outcomes of validation threads for data pack delivery.
 T21.3.04 - PJ.02-21 VALP (V3)
 • Lead Partner: THALES AIR SYS
 • Contributors: ENAV, DFS, ENAIRE, INDRA, LDO
 • Structure and organise all validation threads of the solution. VALP deliverable will encompass reference to individual exercise plans.
 T21.05 - PJ.02-21 Prototype Development (V3)
 • Lead Partner: LDO
 • Contributors: ENAV, DFS, ENAIRE, INDRA, THALES AIR SYS
 • Develop Industry Based Platform and prototypes to support the validation
 T21.06.1 - PJ.02-21 Exercise 1 – Safety Net Düsseldorf Shadow Mode Trials (V3) – (AO-0104-B)
 • Lead Partner: DFS
 • Contributors:

- Validate the Extended Airport Safety Nets Conflicting ATC Clearances (CATC) and Conformance Monitoring Alerts for Controllers (CMAC) in shadow-mode trials at the Düsseldorf airport. The exercise has special focus on the improvement of detection algorithms and the calibration of conflict detection parameters. Moreover, the exercise will investigate human performance aspects regarding the impact of CATC alerts and alert prediction and will address HP-related transition factors (e.g., training needs for controllers).

T21.06.2 - PJ.02-21 Exercise 2 – Real Time Simulation of Dynamic VSB Milan Malpensa (V3) – (AO-0223-B)

- Lead Partner: ENAV

- Contributors:

- Validate the Dynamic Virtual block Control: an enhancement in efficiency and flexibility of the current block control operating method during low visibility conditions is expected to be achieved through the introduction of the Virtual Stop Bars. From safety perspective, both flight crews' and ATCOs' situational awareness is envisaged to be increase by displaying the VSBs on ground HMI and in the on-board AMM. Communication messages as well as the status of VSB are exchanged via Data link.

T21.06.3 - PJ.02-21 Exercise 3 – Real Time Simulation of SMGCS Safety Nets combined with Surface Movement Planning and Routing (V3)– (AO-0104-B, AO-0224)

- Lead Partner: ENAIRE

- Contributors: INDRA

- Validate the Extended Airport Safety Nets and Advanced Automated Assistance for Surface Movement Planning and Routing. This will include the integration of detection of Conflicting ATC Clearances (CATC) on the entire airport surface, an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area within the A-SMGCS systems, and provision of optimised taxi routes for mobiles on the movement area. A-SMGCS takes into consideration the information provided by airport sequencing tools so as to integrate the input from airport DCB processes. These features will be supported by the introduction of an Advanced Controller Working Position that will report an improvement in controllers' productivity. The exercise is planned to be performed using the prototype developed by INDRA on the ENAIRE IBP platform.

T21.3.06.4 - PJ.02-21 Exercise 4 – Real Time Simulation of of Innovative surface manager combined with Safety Nets (V3) – (AO-0104-B, AO-0206, AO-0215)

- Lead Partner: LDO

- Contributors: LDO

- Validate conflict free and/or optimized route planning functionalities for aircraft and vehicles, supported by datalink and traffic display for vehicle drivers, in order to augment their situational awareness. Validate extended and new CATC and CMAC alerts for both aircraft and vehicles.

T21.3.06.5 - PJ.02-21 Exercise 5 – Live Trial of Integrated Surface Management Budapest (V3) – (AO-0206, AO-0222-B)

- Lead Partner: INDRA

- Contributors: HUNGAROCNTR

- Validate use of AGL for providing guidance to aircraft and vehicle drivers in different visibility conditions. Solution will share ATC clearances for vehicles in order to increase their situational awareness using a moving map. The exercise will focus on tailoring routing information and the safety nets function to provide timely information.

T21.3.06.6 - PJ.02-21 Exercise 6 – Real Time Simulation of Enhanced Surface Management (V3) – (AO-0104-B, AO-0222-B, AO-0224)

- Lead Partner: THALES AIR SYS

- Contributors: -

- Validate extended routing and guidance functions, AGL, as well as Conflicting ATC Clearances and Conformance Monitoring Alerts improvements. The exercise will take place on the NAV PORTUGAL Industry Based Platform (exact location TBC) , using the THALES AIR SYS/EDISOFT prototype.

T21.07 - PJ.02-21 Validation Report (V3)

- Lead Partner: DFS / INDRA

- Contributors: ENAIRE, ENAV, LDO, THALES AIR SYS

- Structure and organise all outcomes of the validation threads of the solution. VALR deliverable will encompass reference to Safety and HP cases for V3 Maturity Level.

T21.08 - PJ.02-21 CBA (V3)

- Lead Partner: INDRA

- Contributors: DFS, ENAIRE, ENAV, LDO, THALES AIR SYS

- Prepare the CBA as part of the V3 solution data pack. Cost benefit analyses will be based on outcomes from solution thread and/or internal activities to the task.

Participation per Partner

Partner number and short name	WP6 effort
6 - DFS	65.00
7 - ENAIRE	34.75
CRIDA	23.21
8 - ENAV	31.13
NAIS	11.06
IDS AIRNAV	2.96
TECHNO SKY	24.44
NAV CANADA	10.90
9 - HC (FSP)	34.63
11 - INDRA	429.25
INDRA NAVIA	83.77
IBC	2.16
12 - LDO	123.50
18 - THALES AIR SYS	0.01
NAV PORTUGAL	16.91
EDISOFT	208.21
Total	1,101.89

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D6.1	Solution PJ.02-21: V3 Data Pack	8 - ENAV	Report	Public	33

Description of deliverables

D.6.1 Solution PJ.02-21: V3 Data Pack T0 + 33 months
D6.1 : Solution PJ.02-21: V3 Data Pack [33]
Data pack for the solution including ValR, OSED/SPR/Interop, TS/IRS, CBA...

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS5	V3 Gate for solution PJ.02-21	8 - ENAV	36	

Work package number ⁹	WP7	Lead beneficiary ¹⁰	3 - PANSA (B4)
Work package title	Solution 25 - Safety support tools for avoiding runway excursions		
Start month	1	End month	37

Objectives

- Develop and validate concepts and systems covering the scope and objectives of SESAR Solution PJ.02-25 “Safety support tools for avoiding runway excursions”, addressing the following OI Steps:
 - o AO-0107 — Improved Airport Safety with Better Prevention of Runway Excursions for Tower Controllers
 - o AO-0216 — Enhanced Runway Condition Awareness.
 - o AUO-0606 — Improved Awareness of Runway Friction Evolution.
 - o AUO-0616 — Improved Safety with Better Prevention of Runway Excursions for Pilots.
 - The objective is to achieve a full V3 maturity level at the end of Wave 2.
 - Produce the associated deliverables to this SESAR solution and prototypes
 - In addition to the main deliverables, the solution will produce documentation permitting EASA and National regulation authorities, to take regulatory decisions supporting EU and local applicability
- The outcome of the WP will be packaged to describe ‘deployable’ and standalone solutions.

Description of work and role of partners

WP7 - Solution 25 - Safety support tools for avoiding runway excursions [Months: 1-37]

PANSA (B4), AIRBUS SAS, DASSAULT

T25.01 - PJ.02-25 Solution Management and Communication

- Lead Partner: PANSA (B4)
- Contributors: AIRBUS, DASSAULT
- Coordinate partner and operational stakeholder’s participation, align solution processes with programme delivery processes (PJ19), ensure coordination with Project Lead and PCIT prepare gates, Data pack and Deliverables preparation. Organise communication activities. Support to EATMA modelling.

T25.02 - PJ.02-25 Concept Description (V3)

- Lead Partner: PANSA (B4) with support of UNIWARS AW and MICROSTEP-MIS
- Contributors: AIRBUS, DASSAULT
- Prepare the OS ED/SPR/INTEROP as part of the V3 solution data pack and ensure regular update based on outcomes of validation threads for data pack delivery.

T25.03 - PJ.02-25 Technical Specification (V3)

- Lead Partner: AIRBUS
- Contributors: DASSAULT, PANSA (B4) with support of UNIWARS AW and MICROSTEP-MIS
- Prepare the TS/IRS as part of the V3 solution data pack, review and ensure regular update based on outcomes of validation threads for data pack delivery.

T25.04 - PJ.02-25 VALP (V3)

- Lead Partner: DASSAULT
- Contributors: AIRBUS, PANSA (B4) with support of UNIWARS AW and MICROSTEP-MIS
- Structure and organise all validation threads of the solution. VALP deliverable will encompass reference to individual exercise plans.

T25.05 - PJ.02-25 Prototype Development (V3)

- Lead Partner: DASSAULT
- Contributors: AIRBUS, PANSA (B4) with support of UNIWARS AW and MICROSTEP-MIS
- Develop Industry Based Platform and prototypes to support the validation

T25.06.1 - PJ.02-25 Exercise 1 – RCAMS/OBACS/ROAAS integrated shadow mode exercise (V3) - (AO-0216, AUO-0606, AUO-0616)

- Lead Partner: PANSA (B4) with support of UNIWARS AW and MICROSTEP-MIS
- Contributors: AIRBUS, DASSAULT
- RCAMS in Gdansk and Poprad environment, using AIRBUS and DASSAULT OBACS inputs to help flight crews in their take-off and landing performance assessment.

T25.06.2 - PJ.02-25 Exercise 2 – Take-off monitoring system integrating runway surface condition (V3)- (AUO-0616)

- Lead Partner: AIRBUS
- Contributors: PANSA (B4) with support of UNIWARS AW and MICROSTEP-MIS

- System definition for runway surface condition integration to support flight crew in their take-off performance assessment before departure.
- T25.06.3 - PJ.02-25 Exercise 3 – Controller alert in case of runway excursion risk (V3) – (AO-0107)
- Lead Partner: PANSA (B4)
 - Coordination with EUROCONTROL Solution 14
 - PJ.02-14 Exercise 1 joint exercise to validate AO-0107 (ATCO): “Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival, departure and mix-mode”, in which computed ROT of the flight exceeds the maximum time planned or landing roll of the flight exceeds the runway length
- T25.06.4 - PJ.02-25 Exercise 4 – Workshops (V3) - (AO-0107, AO-0216, AUO-0606, AUO-0616)
- Lead Partner: PANSA (B4)
 - Contributors: EUROCONTROL, AIRBUS, DASSAULT
 - Coordination with EUROCONTROL Solution 14
 - In preparatory phase, workshops will define with end users their performance expectations. Results presentation during workshops will permit a larger audience for validation.
- T25.07 - PJ.02-25 Validation Report (V3)
- Lead Partner: DASSAULT
 - Contributors: AIRBUS, PANSA (B4)
 - Structure and organise all outcomes of the validation threads of the solution. VALR deliverable will encompass reference to Safety and HP cases for V3 Maturity Level.
- T25.08 - PJ.02-25 CBA (V3)
- Lead Partner: AIRBUS
 - Contributors: DASSAULT, PANSA (B4)
 - Prepare the CBA as part of the V3 solution data pack. Cost benefit analyses will be based on outcomes from solution thread and/or internal activities to the task.

Participation per Partner

Partner number and short name	WP7 effort
2 - AIRBUS SAS	5.20
AI OP SAS	51.50
3 - PANSA (B4)	37.48
MICROSTEP-MIS	87.76
UNIWARSAW	139.38
5 - DASSAULT	37.00
Total	358.32

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D7.1	Solution PJ.02-25: V3 Data Pack	3 - PANSA (B4)	Report	Public	33

Description of deliverables

D.7.1 Solution PJ.02-25: V3 Data Pack T0 + 33 months

D7.1 : Solution PJ.02-25: V3 Data Pack [33]

Data pack for the solution including ValR, OSed/SPR/Interop, TS/IRS, CBA...

Schedule of relevant Milestones

Milestone number¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	V3 Gate for solution PJ.02-25	3 - PANSA (B4)	36	

1.3.4. WT4 List of milestones

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
MS1	V2 Gate for solution PJ.02-04	WP3	17 - Swed (SEAC2020)	36	
MS2	V2 Gate for solution PJ.02-14	WP4	1 - EUROCONTROL	36	
MS3	V3 Gate for solution PJ.02-14	WP4	1 - EUROCONTROL	36	
MS4	V3 Gate for solution PJ.02-17	WP5	10 - Honeywell SAS	36	
MS5	V3 Gate for solution PJ.02-21	WP6	8 - ENAV	36	
MS6	V3 Gate for solution PJ.02-25	WP7	3 - PANSA (B4)	36	

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Airspace user involvement	WP3, WP7	Existing cooperation's of AIRBUS, EUROCONTROL, PANSA... with airlines will be used for mitigating that risk
2	NDA process to share data among each partners may be needed to conduct the work	WP3, WP7	Extension of existing NDA in Wave 1 and initiation of the NDA preparation at the earliest stage of the project
3	Lack of ICAO standardisation on the mixed usage of geometric GNSS and Barometric altitude in the TMA	WP3	Proper Airspace design and advanced airborne avionics capabilities
4	Big data and machine learning algorithm performance have to be confirm	WP4	Big data and machine learning expert have been recruited and will allocated to the PJ02
5	Flight simulator used in SESAR 1 may not be available anymore	WP4	Budget has been secured for re-producing the same methodology in a new environment
6	Access to LiDAR wake measurement data for departure	WP4	New measurement campaign could be organised if existing data are not made available
7	Limitation of existing SVGS operations on ILS SA CAT I approaches is a showstopper to widespread dissemination of SVGS capability	WP5	Involvement in standardization groups to contribute to the adoption of SVGS for CAT I and LPV approaches.
8	Method to measure Visual Advantage provided by EVS is not defined for active/radar sensor by FAA/EASA	WP5	Propose and discuss method for measuring Visual Advantage provided by active/radar sensor to EASA and FAA
9	To use active/radar sensor for consistency instead of EVS image is not explicitly allowed by regulation for EFVS operation	WP5	Discuss with EASA and FAA
10	Requirements for CAT II (LPV-100) approach operation supported by augmented GNSS are not explicitly defined	WP5	Discuss with EASA and FAA
11	Validation activities will strongly depend on weather events encountered during the validation period	WP7	wave 1 data collection has been extended to winter 2018/2019 and these data will be available for wave 2

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total Person/Months per Participant
1 - EUROCONTROL	✓	18	21.60	514.60	7.50	0	0	561.70
2 - AIRBUS SAS		0	0	28.88	4.75	0	5.20	38.83
· AI OP SAS		0	0	87.01	81.02	0	51.50	219.53
3 - PANSА (B4)		0	0	0	31.12	0	37.48	68.60
· WASKO S.A.		0	0	0	73.43	0	0	73.43
· MICROSTEP-MIS		0	0	0	0	0	87.76	87.76
· UNIWARSAW		0	0	0	0	0	139.38	139.38
4 - LFV/COOPANS		0	43.44	0	0	0	0	43.44
5 - DASSAULT		0	0	0	26.30	0	37	63.30
6 - DFS		0	0	0	0	65	0	65
7 - ENAIRE		0	0	8.46	4.10	34.75	0	47.31
· CRIDA		0	0	9.02	0	23.21	0	32.23
8 - ENAV		0	0	0	0	31.13	0	31.13
· NAIS		0	0	0	0	11.06	0	11.06
· IDS AIRNAV		0	0	0	0	2.96	0	2.96
· TECHNO SKY		0	0	0	0	24.44	0	24.44
· NAV CANADA		0	0	0	0	10.90	0	10.90
9 - HC (FSP)		0	0	0	0	34.63	0	34.63
10 - Honeywell SAS		0	0	0	268.75	0	0	268.75
· Hlinc		0	0	0	0	0	0	0
· Hlsro		0	0	0	0	0	0	0
11 - INDRA		0	0.80	0	0	429.25	0	430.05
· INDRA NAVIA		0	8.42	0	0	83.77	0	92.19

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total Person/Months per Participant
· IBC		0	0	0	0	2.16	0	2.16
12 - LDO		0	0	20.32	0	123.50	0	143.82
· LDO GMBH		0	0	13.85	0	0	0	13.85
· TPZ		0	0	11.33	0	0	0	11.33
13 - SINTEF (NATMIG)		0	0	15	0	0	0	15
14 - NATS		0	0	39.40	0	0	0	39.40
15 - Avinor-SEAC2020		0	4	0	0	0	0	4
16 - HAL (SEAC2020)		0	0	3	0	0	0	3
17 - Swed (SEAC2020)		0	13	0	0	0	0	13
18 - THALES AIR SYS		0	144	0	0.01	0.01	0	144.02
· SEARIDGE		0	0	0	3.59	0	0	3.59
· NAV PORTUGAL		0	0	0	14.01	16.91	0	30.92
· EDISOFT		0	0	0	127.94	208.21	0	336.15
19 - THALES AVS		0	30.71	0	105.66	0	0	136.37
20 - ANS CR (B4)		0	0	0	0	0	0	0
21 - LPS SR (B4)		0	0	0	0	0	0	0
22 - ON (B4)		0	0	0	0	0	0	0
23 - ACG/COOPANS		0	0	0	0	0	0	0
24 - CCL/COOPANS		0	0	0	0	0	0	0
25 - IAA/COOPANS		0	0	0	0	0	0	0
26 - Naviair/COOPANS		0	0	0	0	0	0	0
27 - ATOS (FSP)		0	0	0	0	0	0	0
28 - FRQ (FSP)		0	0	0	0	0	0	0
29 - AIRTEL (NATMIG)		0	0	0	0	0	0	0
30 - SAAB (NATMIG)		0	0	0	0	0	0	0
31 - ADP (SEAC2020)		0	0	0	0	0	0	0

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total Person/Months per Participant
32 - MUC (SEAC2020)		0	0	0	0	0	0	0
33 - SNBV (SEAC2020)		0	0	0	0	0	0	0
34 - ZRH (SEAC2020)		0	0	0	0	0	0	0
Total Person/Months		18	265.97	750.87	748.18	1101.89	358.32	3243.23

1.3.7. WT7 Tentative schedule of project reviews

Review number ¹⁹	Tentative timing	Planned venue of review	Comments, if any
RV1	15	SJU	Review linked to first reporting period
RV2	27	SJU	Review linked to second reporting period

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the JU). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent filings, videos, etc.
OTHER	
ETHICS	Ethics requirement
ORDP	Open Research Data Pilot
DATA	data sets, microdata, etc.

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

- PU Public
- CO Confidential, only for members of the consortium (including the Commission Services)
- EU-RES Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
- EU-CON Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
- EU-SEC Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number: MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

- VA if virtual access,
- TA-uc if trans-national access with access costs declared on the basis of unit cost,
- TA-ac if trans-national access with access costs declared as actual costs, and
- TA-cb if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

PJ.02 - W2 AART

Title of Proposal:

SESAR 2020 IR-VLD WAVE 2 - PJ.02 AIRPORT AIRSIDE AND RUNWAY THROUGHPUT (AART)

History of change

EDITION	DATE	STATUS	AUTHOR	CHANGES
v0.1	04/09/2019	Draft	V. Treve	Objectives of the Solution 4 have been up dated
				Relation to the SESAR 2020 Work programme for Solution 4 have been updated
				Relation to the SESAR 2020 Work programme for Solution 14 have been updated
				Concept has been up-dated for Solution 14
				Methodology has been up-dated for Solution 04
				Methodology has been up-dated for Solution 14
				Methodology has been up-dated for Solution 21
				Ambition has been up-dated for Solution 14
				Figure 2 Gantt has been up-dated
				Resource to be committed to Solution 04 has been up-dated
				Resource to be committed to Solution 14 has been up-dated
				Resource to be committed to Solution 21 has been up-dated
				Table 3.4b: 'Other direct cost' items has been up-dated
V1.0	30/09/2019	Final	V. Treve	Resource to be committed to Solution 17 has been up-dated
				Modification of the members of the consortium description: ENAV
				Modification of the members of the consortium description: HONEYWELL
				Description of the third parties involved in the project (including use of third party resources): EUROCONTROL
				Description of the third parties involved in the project (including use of third party resources): AIRBUS
				Description of the third parties involved in the project (including use of third party resources): PANSA
				Description of the third parties involved in the project (including use of third party resources): DASSAULT
				Description of the third parties involved in the project (including use of third party resources): ENAIRE
				Description of the third parties involved in the project (including use of third party resources): ENAV
				Description of the third parties involved in the project (including use of third party resources):
				Description of the third parties involved in the project (including use of third party resources): INDRA
				Description of the third parties involved in the project (including use of third party resources): LEONARDO
				Description of the third parties involved in the project (including use of third party resources): SWEDAVIA
				Section 4.3: "Global Approach taken by SJU members" removed
V1.1	08/10/2019	Final	V. Treve	Section 3.4.3, Exercises number up-dated
				Section 1.3.2.4.7: Update Ex5 information
				Section 1.3.3: Up-date OIs in Exercise 5
				Section 3.4: The first instalment description added
				Section 3.4.4 and 3.4.6: References to LTPs removed
V1.2	28/10/2019	Final	V. Treve	Table 3.4b: LFV COOPANS text and figures up-dated
				Table 3.4b: HC (FSP) text and figures up-dated
				Section 3.4.1 to 3.4.6 removed and associated references
				Section 4.2 up dated for subcontracting cost of LDO, LFV/COOPANS and Swed (SEAC2020)
V1.3	04/11/2019	Final	V. Treve	Section 4.2 up dated for subcontracting cost of THALES AIR SYS
				Section 4.2 up dated for LTP, subcontracting cost of Airbus
				Reference to Section 3.4 removed from Section 1.3.2
V1.4	22/11/2019	Final	V. Treve	Table 3.4b: LFV COOPANS text and figures up-dated
				Section 4.2: Subcontracting tasks removed for LFV/COOPANS and THALES AIR SYS
				Section 4.2.2: Airbus LTP task description added

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1 Excellence

This project is part of the SESAR 2020 Multi Annual Program for the period 2020-2022. It is part of the Industrial Research & Validation phase, developed under the SJU Private Public Partnership.

The key feature is “High Performing Airport Operations” and the topic is “PJ02 W2 Airport airside and runway throughput”.

The project is called **AART: Airport Airside and Runway Throughput**.

At capacity constrained airports, traffic demand for runway operations can exceed the runway capacity.

With the expected rapid growth in air traffic, there will be an increasing number of capacity-constrained airports for significant periods of each day, and this situation will become even more critical under adverse weather conditions. Airports will have to improve the efficiency of runway operations and their resilience in visually and/or meteorological challenging conditions. This can be achieved by fully integrating surface management tools with other systems including runway occupancy time prediction, wake separation and arrival and departure management (AMAN/DMAN) systems. In turn the integration of surface management tools with other systems will further reduce the number of incidents / accidents at the airport e.g. collisions on the apron and taxiway with traffic and/or fixed obstacles.

Airports and airlines need to enhance their capability to deliver, plan and improve the use of airport resources so that costs, emissions and fuel consumption can be reduced, whilst improving quality of service and hence passenger satisfaction.

Considering this statement, PJ02 addresses situations of over-demand on capacity-constrained airports related to the optimisation of ground management and separation minima, addressing constraints such as weather, environment, noise, runway configuration, mixed mode operations, surveillance and traffic mix, with a view to optimising airport operations with existing infrastructure, improving safety and environment.

1.1 Objectives

The following key objectives of PJ02 W2 Airport airside and runway throughput, structure the project:

- Develop and validate the proposed operational improvements (OI Steps) and main technical enablers (ENs) to V1, V2 or V3 maturity level in Wave 2 whilst ensuring quality deliverables that support the development of standards leading to deployment.
- Deliver cost benefit analysis, technical and performance assessments covering safety, capacity, efficiency, resilience, environment and noise, access and equity, and human performance to facilitate deployment decisions, specifically addressing:
 - Airport and Airspace TMA Capacity - Increase runway and airspace throughput (e.g. reducing runway occupancy time, or arrivals and departures wake turbulence separation) and resilience;
 - Maintain or increase runway, taxiway and apron safety levels, increase situational awareness, ATC Workload maintained or reduced
 - Improved access to secondary airports, with expected benefits in resilience, cost-efficiency and increased flexibility under non-nominal conditions at the airport;
 - Increased predictability and airport efficiency (e.g. runway occupancy time, runway exit and departure rotation)
 - Reduced fuel consumption and noise near the airports;
- Disseminate and communicate the validation results and performance benefits to ensure industry awareness and timely exploitation in the context of European regulations and SESAR Deployment.

As per the SESAR Multi-Annual Work Programme, the SESAR Solutions addressed by this proposal include:

- PJ.02-04: Advanced geometric GNSS based procedures in the TMA
- PJ.02-14: Evolution of separation minima for increased runway throughput
- PJ.02-17: Improved access to secondary airports
- PJ.02-21: Digital evolution of integrated surface management
- PJ.02-25: Safety support tools for avoiding runway excursions

The project addresses a total of 36 Operational Improvements.

Whilst the current EATM Master Plan is DS18 release, several existing Change Requests (CRs) targeting future DS releases are taken into account by this proposal so to be complete and consistent. Where appropriate, the CR number will be mentioned in order to enable access to its content when assessing this proposal.

The following text describes the objectives for each solution, the expected performance benefits are described in Section 2.1. The list of acronyms and references are presented in Part B Section 4-5 of the proposal.

1.1.1 Solution 4 - Advanced geometric GNSS based procedures in the TMA

The objectives of PJ.02-04 are:

- Investigation of the management of advanced curved operation in the TMA (arrival and departure) to improve the runway throughput, lower the environmental impact and increased predictability in high-density TMA operation.
- To investigate the management of advanced curved operations mixed with legacy straight-in approach operations to optimize the efficiency of airspace, enabling the maximum use of advanced curved operations. This implies providing minimum separation between aircraft using both straight-in and curved approach procedures when aircraft are experiencing different meteorological conditions, such as different wind components along its trajectory flown. It will have a direct impact on the aircraft speed relative the ground in a highly dynamic manner, when many different routes are flown. This requires development of system support tools for ATCOs, advances in airspace design, and development of ATC and airborne procedures including new avionics.

The objectives, related to GNSS based procedures in TMA, are considered realistic and achievable in the timeframe of the project. The validation activities will largely benefit from existing platforms, previous work and experience gained in the ongoing project SESAR Wave 1 PJ.02.11 - Enhanced Terminal Area for efficient curved operations. V2 maturity for solution 4 will be achieved through planned validation activities, including Real Time Simulations, Fast Time Simulations and Expert Group Meetings, involving all partners.

The objectives related to Enhanced Terminal Area for efficient curved operation (AOM-0607) and Enhanced Parallel Approach Operations using PBN/RNP transitions to RNP (for at least one runway) (AOM-0608) are considered realistic and achievable in the timeframe of the project considering that:

The new prototype for system support tool for ATC is based on an existing functionality used for Time Based Separation (TBS) including the HMI. The existing tool will be used as a starting point for extending its use to this foreseen more dynamic operational concept. In addition, runway throughput will be validated, using an existing state-of-the-art platform.

The objectives related to Enhanced Parallel Approach Operations using PBN/RNP transitions to xLS (AOM-0606) are considered realistic and achievable in the timeframe of the project considering that:

Transition from barometric to GNSS altitude was explored in two different validation activities in SESAR Wave 1 PJ.02.11, and re-usage of one previously platform is planned. The other planned platform to be used is an existing industrial platform that will be further developed to meet the V2 objectives.

The objectives, related to more flexible SID design by reducing divergence angle between independent departures (AO-0313 - created via CR-02772) are considered as realistic and achievable in the timeframe of the project considering this will add on to results already produced in SESAR Wave 1 PJ.02.11 and existing platforms to be used.

For the arrival phase, flight path shortening in the magnitude of at least 10 NM is expected for each aircraft flying an advanced curved arrival and approach procedure. We estimate at least 70% of all aircraft being capable of doing this when the Concept is fully developed. This corresponds to fuel savings in the magnitude of 90 kg per arriving aircraft for a typical intra-European flight (today's operation), when flying an advanced curved arrival and approach procedure.

For the departure phase, an advanced curved procedure flown immediately after departure has the potential to lower the flown distance by at least 5 NM, corresponding to fuel savings in the order of 35 kg for a typical intra-European flight.

Aircraft noise will have the potential to be distributed differently, due to great flexibility in trajectories flown. In addition, CCO and CDO will lower noise, due to less aircraft flying level flight in lower altitude regions.

For the departure phase, runway throughput is expected to increase quite substantial, due to the fact that each departing aircraft, flying an advanced curved departure route will have the possibility to start turning at the Departure end of the runway.

For the arrival phase, runway throughput is expected to be maintained or slightly increased with the introduction of this new concept.

ATCO and pilot workload is expected to decrease, with the introduction of advanced curved operation in the TMA. This is due to more closed-loop procedures flown, improved system support tools for ATCOs and enhanced avionics for the airborne side.

1.1.2 Solution 14 - Evolution of separation minima for increased runway throughput

The objective of PJ.02-14 will be:

- To revise separation minima depending on dynamic information (e.g. wind/weather, flight plan, differentiated rotation position) in order to increase arrival and departure runway capacity, fuel efficiency, predictability and resilience while maintaining or increasing safety : Dynamic Pair Wise Separation for Arrival and Departure, Dynamic Runway Separations (based on Runway occupancy Time) for Arrival, Departure Operations. That will bring an additional 3 to 5% capacity on the top of Wave 1.
- To mitigate the impact on ATCO workload and Human Performance, and to deliver cost efficiency targets, more efficient separation delivery tools delivering a more precise spacing beyond what has been done by PJ.02 in wave 1 will be developed. A reduction of 50% of the buffer taken today on separation is achievable, what corresponds to 2 to 5% capacity.
- To finalize the concept of Enhanced Approach procedures (EAP) as started in Wave1. Reduction in noise are currently quantified in Wave 1 while capacity can be increased from 2 to 4%.
- To refine and consolidate static pairwise separation matrixes for successive arrivals, successive departures and between arrivals and departures which need further safety evidence for supporting regulatory approval process and further optimisation of the assessment methodology for integrating additional / new aircraft types and increase operational benefits for deployment of the pair-wise separations established in wave 1.
- To define new operational concept(s) required for the coordination between tower and approach controllers in order to be able to safely manage the increased runway throughput enabled by the new concepts in mixed-mode operations.

The objectives, related to the revision of separation minima (wake or related to runway occupancy time), are considered as realistic and achievable in the timeframe of the project considering that the methodology for wake separation design has been reviewed and approved by EASA and will be extended to the use of more dynamic information. New LiDAR and Flight Simulation campaigns will be organised for complementing existing wake databases.

The objectives, related to the more efficient separation delivery, are considered as realistic and achievable in the timeframe of the project considering that the HMI and overall logic prevailing for the TBS delivery tool will be used as starting point for extending its use to more dynamic concepts. Additional functionalities for more efficient definition of separation buffers coping with aircraft behaviour and wind evolution will also benefit from experience gained in Wave 1 and Safe Cloud(H2020) results that have demonstrated feasibility of more efficient machine learning/big data (ML/BD) methodologies.

The objectives, related to the validation of Enhanced Approach procedures (EAP), are considered as realistic and achievable in the timeframe of the project considering this work will complete validation undertaken in Wave 1 and that minimum additional work is required to complete.

The objectives, related to consolidate static pairwise separation matrixes, are considered as realistic and achievable in the timeframe of the project considering it is the refinement and formalisation of V3 in Wave 1 validation outcomes.

The objectives, related to new mixed-mode operational concept are considered as realistic and achievable in the timeframe of the project considering this will build on results already produced in Wave 1 that considered mixed-mode through the work dedicated to the optimised separation delivery for departure optional enabler dedicated to mixed-mode operations.

The objectives, related to Dynamic Adjustment of Spacing Depending on Wake Turbulences, are considered as realistic and achievable in the timeframe of the project considering that:

- a technical solution already exists on the ground to compute a target distance in NM between two following flights (based on Time Based Separation, and potentially augmented with RECAT and Runway Occupancy Time estimation),
- a technical airborne solution (“ATSAW+”) has been developed in SESAR2020 Wave 1 to enable Airborne Spacing monitoring
- and that the work will primarily consist in assessing the HMI and procedures mostly in terms of human factor.

1.1.3 Solution 17 - Improved access to secondary airports

The objective of PJ.02-17 is to enhance availability and accessibility of secondary airports, and therewith improve transport capacity. Availability and accessibility are challenges for those airports since they are typically not well equipped for supporting traffic in adverse weather conditions.

This project will build upon the results of SESAR Wave 1 work from PJ02-06, PJ03b-01, PJ.14.4.3, PJ03a-04, PJ02-06, SESAR2020 Exploratory project ENVISION and the VLD project Augmented Approaches to Land 2. It will address both ground based systems and airborne systems.

The ground part of this project will concentrate on further research of Alternative Ground Surveillance. It will consider the use of cameras and already existing air sensors, as primary surveillance sensors (not excluding use other surveillance means in combination). It will also evaluate low-cost Vehicle Tracking and secondary airports' safety nets (validated in PJ03b-01's AO-0108) and their impact on capacity and network predictability and efficiency. The validation exercises will deliver innovations to each individual enabler and OI step as defined in the "D4.4 Performance Framework" and "D4.5 Validation Targets (2018)", which have been developed during SESAR2020 Wave 1 by PJ 19 Content Integration.

The airborne aspect will focus on the validation of new vision systems and LPV-100 capabilities and related procedures. This will enable aircraft to perform approaches and landings at lesser equipped airports during lower visibility meteorological conditions and therefore support All Weather Operations (AWO). As a result of lesser missed approaches or diversions, the airport capacity / resilience to LVC is expected to significantly increase. This airborne capacity can be achieved by providing means to extend the visual segment upwards (vision systems), and means to lower the decision height (vision systems, LPV-100) in low visibility conditions. The vision systems research work will focus on the validation of new Enhanced Flight Vision Systems, Synthetic Vision Guidance Systems, Combined Vision Systems and their impact on operation (NPA AWO). Studies will be performed, as well as simulations and validations of innovative concepts like active sensors supporting CVS approach operation, and SVGS operations with HUD. The LPV-100 capability will be provided by GNSS (MCMF SBAS) and work will depend on the maturity and actual timing of deployment of new GNSS signals.

1.1.4 Solution 21 - Digital evolution of integrated surface management

Objective of PJ.02-21 are

- to increase pilots' and vehicle drivers' situational awareness in all weather conditions thanks to provision of supplementary guidance means,
- to increase efficiency in controller's work on surface management,
- to optimize and secure communication between controllers, pilots and drivers and
- to prepare the detection limits in cooperation with local ATCOs and calibrating the conflict detection service accordingly is a first step to optimise the timely triggering of the safety net alerts.

To further reduce safety net nuisance alerts, it is necessary to provide additional tactical planning information to the conflict detection service (as indicated by the Wave 1 results). Pushback sequence and departure sequence are such essential tactical planning information to develop an optimal traffic flow. Including the tactical planning into the conflict detection shall reduce the number of nuisance alerts drastically, especially at airports with dense traffic flows during peak hours. Furthermore, conditional clearances for apron and taxiway operations shall be entered to the system, giving the conflict detection service a clearer picture of the tactical intentions of the controller. All measures combined shall give well-timed alerts without a significant number of nuisance alerts. Compared to taxi operations without the addressed CATC and CMAC alerts the expected percentage of correctly and otherwise not or too late detected conflict situations of 90% is achievable.

The objectives are considered as realistic and achievable based on the work already performed in SESAR 1, OFA04.02.01 Integrated Surface Management and further refined in SESAR 2020 Wave 1 Solutions PJ03a-01 and PJ03b-01 where relevant information and data will be used as a starting point for the work planned in PJ.02-21. Validations activities taking place at different sites (Düsseldorf, Milano Malpensa, Budapest, Sofia and Barcelona) with controllers from different environment and background will bring a wide area of expertise to evaluate and analyse the concepts, this will be a major asset for the outcome of the project. A rough quantification for each of the expected objectives can be derived from the performance benefit figures collected within the PJ03a-01 and PJ03b-01 V2 Validation framework, whose data packs are under finalisation.

1.1.5 Solution 25 - Safety support tools for avoiding runway excursions

The objective of PJ.02-25 aims at mitigating the runway excursion risk at any airport operational environment, based in particular on the ICAO Global Reporting Format relating to runway surface conditions.

The solution target is to improve safety by providing the flight crew with more accurate and continuously updated information about current condition and trend of the runway surface, so that it improves resilience to adverse weather situations. Better management of runway inspections, less flights diversions due to bad runway conditions and optimised decontamination operations will lead to increase of airport availability. The exercises will focus on delivery of targets apportioned by the “D4.4 Performance Framework” and “D4.5 Validation Targets (2018)” that have been developed during SESAR2020 Wave 1 by PJ 19 Content Integration”.

The objectives, related to PJ.02-25, are considered as realistic and achievable in the timeframe of the project considering that the SESAR 2020 PJ.03b-06 solution will achieve V2 maturity level in wave 1, and the solution Partners have vast experience from SESAR 2020 Wave 1 validations.

1.2 Relation to the SESAR 2020 Work programme

This section explains how the proposal addresses the specific challenges and scope of the topic, as set out in the SESAR JU Single Programming Document 2019-2021 (SPD).

Whilst the SPD was based on the EATM Master Plan DS18 release, this proposal takes into account several existing CRs (targeting future DS releases) so to be complete and consistent. Where appropriate, the CR number will be mentioned in order to enable access to its content when assessing this proposal.

For each OI Step targeting V3, the list of enablers is given together with the following information:

- enabler required or optional for the specific V3 OI Step validation in the PJ.02 Solution;
- enabler addressed or not addressed in the PJ.02 Solution Validation activities;
- V3 dependencies with S2020 Projects;
- enablers that reached/expected to reach V3 maturity during SESAR 1 or pre-SESAR (highlighted in green).

Deviations from the SESAR 2020 Work programme are justified in Section 1.3 for each solution.

1.2.1 Solution 4 - Advanced geometric GNSS based procedures in the TMA

Description of topic and how addresses specific challenges and scope

1.2.1.1 Topics

The solution will:

- Develop an ATC system support tool prototype for ATCOs to manage arriving aircraft, flying advanced curved and straight in approaches (**AOM-0607** and **AOM-0608**) to maintain or increase high runway throughput with lowered environmental impact.
- Developed supporting material for design and operational criteria requirements regarding advanced curved departure procedures (**AOM-0607** and **AO-0313** - created via CR-02772) to increase runway throughput and improve environmental performance.
- Explore the operational requirements of transition from barometric to GNSS altitude in the arrival route and final approach segments (**AOM-0606** and **AOM-0607**) to enable Advanced CDO.

1.2.1.2 Challenges and scope

1.2.1.2.1 Enhanced Terminal Area for efficient curved operation (AOM-0607)

In today's operation, curved approach procedures (RNP AR APCH) are implemented to several Airports and runway ends and typically used in low density traffic scenarios. By design, these arrival procedures are extremely efficient from an AU and Airport perspective since they are associated with shorter arrival routes, thereby reducing fuel consumption, flight time and CO₂ emissions for AUs and have the ability to avoid noise sensitive areas in the airport proximity.

In Solution 4, the scope is to manage more advanced curved operations, simultaneously mixed with traditional straight-in approaches in medium to high traffic conditions. A wide variety in aircraft performance and technical capability for many years to come is foreseen, whereas we also need to provide efficient Air Traffic Control in mixed mode operation. Non-nominal operational aspects of GNSS outage in the TMA will be covered during a RTS activity.

For the departure phase, advanced curved procedures, currently not in use is considered as a very important enabler to improve runway throughput and improving the environmental footprint.

The main challenges of AOM-0607:

- Identification and description of Concept of Operations.
- Identification of the expected benefit of the Concept of Operations.
- Identification of potential issues that could prevent the development of the Concept.
- Identification of the ground system requirements to enable the Concept of Operations.
- Analysis of the impact on the avionics.
- Identification of performance requirements for automatic downloading of on-board captured meteorological information with respect to wind direction and wind speed.
- Identification of requirements for monitoring and alerting of loss of GNSS availability and subsequent recovery of non GNSS supported operations.
- Analysis of the transition from barometric to geometric altitude.
- The use of different GNSS references for altitude and its impact on the Concept of Operations.
- The transition between different types of GNSS based navigation concepts.
- Procedure design.
- Quantification of required turn radii, the impact of aircraft bank angles at low altitudes to ensure stable flight trajectories.
- Reduction of temperature impacts on the vertical flight path, increasing safety and reducing flight crew workload in high/low temperature condition.
- Feasibility analysis of 3D curved operations to independent parallel runways.

1.2.1.2.2 Enhanced Parallel Approach Operations using PBN/RNP transitions to xLS (AOM-0606)

The scope is linked to using a transition from barometric to geometric altitude after the Initial Approach Fix and completes this transition prior to the Final Approach Point, which is an enabler for Advanced CDO. The optimisation of this transition phase needs to be determined, and will have impact on airborne avionics, airspace design, ground systems and ATC operating methods. It is expected that AOM-0606 will contribute to an increase in ATM performance in terms of runway throughput and lowered environmental impact compared to today's operation. In addition, lowered reduced missed approach rates are foreseen, due to usage of geometric altitude prior to the Final Approach Point. It is of importance to determine the ATCO needs to enable this Concept of Operations in terms of system support, but also determine what the requirements will be on airspace design.

The scope of AOM-0606 encompasses the following objectives:

- To further increase ATM performance in terms of runway throughput and lowered environmental impact compared to today's operation.
- To determine the ATCO needs to enable this operation in terms of system support.
- To determine the impact of runway throughput with this concept.

The main challenges of AOM-0606:

- Identification and description of Concept of Operations.
- Identification of the expected benefit of the Concept of Operations.
- Identification of the ground system requirements to enable the Concept of Operations, taking mixed mode operation into account as well.
- Optimisation of NTZ management for parallel runway operations.

1.2.1.2.3 Enhanced Parallel Approach Operations using PBN/RNP transitions to RNP (for at least one runway) (AOM-0608)

Recently, ICAO published amended documents covering parallel runway operations (November 2018) and R&I activities in this Solution will explore further improvements to the existing ICAO standards and integrating this concept into a high density mixed mode environment. Therefore, focus in Solution 4 for the arrival phase is on enabling these advanced curved procedures into parallel runway operations, with special consideration in Wave 2 on ATCO ground tools and working methods whilst ensuring adequate runway throughput, when also considering mixed mode operations.

The main challenges of AOM-0608:

- Identification and description of Concept of Operations.

- Identification of the expected benefit of the Concept of Operations.
- Identify the potential to reduce the MRS between pairs of aircraft flying PBN approaches to parallel runways; this may include not only when both aircraft are already established on the final approach but also for aircraft that are on an RF turn to final, thereby allowing a full descent clearance to be delivered before both aircraft are aligned.
- Analysis of new candidate PBN navigation specifications allowing reduced separations during independent parallel runway operations.

1.2.1.2.4 More flexible SID design by reducing divergence angle between independent departures (AO-0313)

In today's operation, advanced curved departure procedures are not deployed in a consistent manner due to lack of ICAO reference material, but is considered of paramount importance to improve runway throughput and lower environmental impact of aviation. Solution 4 will follow-up on work performed by SESAR Solution PJ.02-11 in Wave 1 and focus will be on optimisation of curved departures (fixed radius turns) immediately after departure, including investigation of meteorological aspects and future requirements (both ground and airborne aspects) related to this concept. In addition, the scope encompasses activities related to determine an optimum divergence angle between independent departures for parallel runway operations.

The main challenges of AO-0313:

- Identification and description of Concept of Operations.
- Determine an optimum divergence angle between independent departures for parallel runway operations.
- Identification of design characteristics for immediate curved departures (fixed radius turns).
- Investigate how optimization of the curved departure procedure can be done with reference to different meteorological conditions and its impact on flight efficiency.
- Ensuring that appropriate runway throughput is maintained.

1.2.1.3 Problem Statement, Geographical spread and timescale

During SESAR Wave 1, PJ.02-11-Enhanced Terminal Area for efficient curved operations conducted initial work on curved flight procedures in the arrival and the departure phase, including usage of geometric GNSS based altitude in the arrival phase at V1 level. There is a need to further continue this work by studying the application of GNSS usage in the TMA to support efficient curved operations. Airborne capabilities to conduct various PBN navigation specifications (e.g. RNP AR Approach), RNP to xLS, and general usage of fixed radius turns is mature in the horizontal dimension. In the vertical dimension, navigation outside the final approach exclusively relies on barometric altimetry today, which is affected by temperature and altimeter reference setting. Note that, while the RF capability is mature, its application still remains limited today (most of its use is limited to RNP AR procedures).

One of the key areas that needs further R&D is to determine what impact curved operation in the extended TMA will have on ATC working methods and what system support needs that are required to enable such operations (e.g. a separation support tool), including a mixed airborne equipment environment. In addition, the proposed Concept of Operations should have no negative impact on runway throughput, compared to today's operation.

The geographical spread of the proposed Concept is depending on the underlying navigation source. The whole region could be considered, e.g. RNP AR Approach or newer PBN navigation specifications like Advanced RNP, whilst other limitations could occur, when considering usage of GBAS (depending on ground station availability) and/or any limitation in SBAS coverage.

Timescale is not a limiting factor except if barometric altitude usage is considered in the approach phase, which could be temperature limited (e.g. winter operation). However, this is mitigated by usage of geometric altitude, including usage outside the final approach segment by RNP to xLS.

1.2.2 Solution 14 - Evolution of separation minima for increased runway throughput

Description of topic and how addresses specific challenges and scope

1.2.2.1 Topics

The solution will

- Develop more efficient separation delivery tool supporting implementation of the complex separation rules in complex, capacity constrained airport environments for arrivals and departures (AO-0334 created via CR-02769 and AO-0315 created via CR-02767)

- Develop ATCO support tool to predict ROT and support ATCOs on the feasible runway exit point for more efficient arrival operation (**AO-0335** created via CR-02770 and **AO-0336** created via CR-02798).
- Finalise the development of Enhanced Approach procedures (**AO-0308**, **AO-0319**, **AO-0320**, **AO-0321** and **AO-0331**) allowing to reduce noise print around the airports while increasing or maintaining runway throughput by reducing wake separation minima.
- Refine guidance, safety case and material supporting regulation of the Static pairwise separation matrix for arrival and departures (**AO-0306** and **AO-0323**)
- Define criteria and procedures for defining Dynamic Wake Separation for arrival and departure (**AO-0307** and **AO-0324**).
- Assess the delegation of separation procedure using ATSAW+ and related air-ground exchange procedure (**AUO-0504**). Despite that the OI Step explicitly refers to a datalink communication to support the exchange; it is likely the Solution will use traditional voice communication to support such a feature.

1.2.2.2 *Challenges and scope*

1.2.2.2.1 Optimised Separation Delivery (complex separation rules) for arrival and departure (AO-0334 and AO-0315)

The scope includes the development of advance computation of separation markers of a decision support tool based on the enablers of the AO-328 for controllers to deliver a more precise spacing in the TMA beyond what has been done by PJ.02 in wave 1.

More efficient arrival separation delivery between arriving aircraft will be achieved by using more accurate prediction of final speed profile and wind also using big data / machine learning (BD/ML) techniques, considering the effect of traffic mix using different approach procedures such as Increased glide slope and/or displaced thresholds (AO-0308, AO-0319, AO-0331, AO-0320, AO-0321).

More efficient departure separation delivery between departing aircraft using better prediction of rolling distance and departure speed profile and trajectory also using big data / machine learning techniques improving the validated AO-329 enablers.

The development of the OI Steps will provide an ATC tool supporting monitoring systems that detect emergent evolutions of aircraft behaviour, with the objective of supporting the continuous adaptation of the target indicators in order to replicate human adaptive behaviour using big data, machine-learning and more advanced wind “now-casting” algorithms.

The solution will use flight specific information (e.g. speed schedule in approach, vertical climb profile for departure) in order to support reduced separations between arrivals and/or departures. This can be obtained via:

- New information to be added to the future evolution of the flight plan e.g. final approach speed planning;
- Downlinking information from the aircraft. For the downlink of flight specific parameters from the aircraft, the EPP should be considered. If needs beyond what EPP can provide are identified, the research may propose a new ADS-C contract (yet to be defined depending on the needs).
- The solution may explore the usability of the final approach speed schedule planned before departure, and if benefits are proved propose that the addition of this element is considered in the FF-ICE evolution, considering that the eFPL does not include the planned speed schedule for final approach.

Enablers list will be frozen once V2 completed.

The main challenges of AO-0334 and AO-0315 will be:

- The design and validation of ATC support tools to manage separations for arrivals and departures, which will focus on aircraft behaviour modelling and weather now-casting function
- The downlinking element and integration of the downlinking parameters in the tools
- The integrity and accuracy of calculation
- Specification of prevailing logic between all constraints defined in AO-0328 and AO-0329 .
- Definition of advanced BD/ML methodology for coping more efficiently with uncertainty separation buffer

1.2.2.2.2 Dynamic Pairwise Runway Separations for Arrivals (based on ground information) (AO-0335)

The scope includes the development of more efficient ROT prediction and runway exit point of approaching aircraft. In a first step the ground-based ROT prediction will be based only on static aircraft characteristics such as aircraft type, weight, equipage (EBS/non-EBS) and weather conditions. The use of machine learning and data driven predictions will be assessed to improve post-operations offline analysis together with

continuous monitoring and improvement of the quality of the predictions during operations as a runway occupancy system support tool for the ATCO. This research builds on Wave 1 research conducted within solution #02-08 and Safe Cloud but goes beyond that solution that may be achieved at the end of wave 1 V3 maturity.

The development of the OI Steps will provide an ATC tool for issuing landing clearances in an increased runway throughput environment, e.g., predicting the runway exit point, the likelihood that an aircraft will not exit as expected, the likely distance between two arrivals at the point the leader is exiting the runway to inform the ATCO that a landing clearance can be issued in sufficient time when separation is reducing or that a given aircraft will be spending more time than expected on the runway potentially compromising a following landing or departing aircraft.

Enablers list will be frozen once V2 completed.

The main challenges of AO-0335:

- Definition of an advanced BD/ML methodology for predicting the expected ROT, rolling distance, runway exit point, rolling distance of departing aircraft
 - Definition of advanced BD/ML methodology for coping more efficiently with uncertainty buffers.
- 1.2.2.2.3 Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (AO-0336)

The scope includes the development of more efficient ROT prediction and runway exit point of approaching aircraft and rolling distance of departing aircraft based on aircraft-based ROT prediction and A/G exchange. The ROT prediction will be calculated by the aircraft and then downlinked to the ground (e.g. via CPDLC) for better separating aircraft and in order to support flight crews expedite runway vacation.

The development of the OI Steps will provide ATC with information for issuing landing clearances in an increased runway throughput environment, e.g. predicted runway occupancy time (based on aircraft performance, pilot inputs, weather data, etc) and predicted runway exit point. Additionally the development will include a possibility for the ATCO to provide a target maximum ROT to the aircraft, to be considered by the pilot.

The solution will use dynamic information broadcast or downlinked from the aircraft for providing the ATC with an aircraft-predicted ROT, or the uplink from the ground to the aircraft of relevant information in real time.

Enablers list will be frozen once V2 completed.

The main challenges of AO-0336 will be:

- Definition of methodology for ROT definition from on-board data and pilot braking strategy (aircraft equipped or not of specific braking mode)
 - Quantify the benefits of reduced ROT on runway throughput (arrival only for segregated Runway / departure + arrival for mixed mode runway), using AirTop platform
- 1.2.2.2.4 Enhanced Approach Procedures (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)

The various Enhanced Approach Procedures are: Displaced Threshold (AO-0308), Second Runway Aiming Point (AO-0319), Increased Glide Slope (AO-0320), Adaptive Increase Glide Slope (AO-0321) and Increased Glide Slope to Second Runway Aiming Point (AO-0331).

The scope includes for SRAP and IGS-to-SRAP: Advanced design for visual aids (runway markings, approach lightings), covering both cases of thresholds spaced by more or less than 1000m; for IGS & IGS-to-SRAP: refinement of flight guidance for slopes above 3.5° (up to 4.49°) and under challenging operating conditions (light tailwind, inversion, wet runways), refinement of the wake turbulence risk assessment integrating data-driven vertical navigation total system error analysis; for A-IGS: Integration into separation delivery tool for ATCOs, uplink of final approach wind profile, refinement of the wake turbulence risk assessment; for DT: Permanent or dynamic dual threshold will build on SRAP outcomes. Combination of OI Steps will also be considered. The solution will also finalise regulatory material and associated safety cases of separation minima defined as a function of the enhanced approach procedures flown. The focus in those OI steps will be on the required EN on the ground side (see table below).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0335	AERODROME-ATC-70	Required	Yes	Aerodrome ATC system to support Dual Threshold operations	Those ENs are both enabled by REG-0527 [Regulatory provisions for Dual Threshold operations (DT)] which PJ02 will also mature.
	APP ATC 116	Required	Yes	Approach ATC system to support Dual Threshold operations	
AO-0319	AERODROME-ATC-25	Required	Yes	Aerodrome ATC system to support second runway aiming point operations	Those ENs are both enabled by REG-0529 [Regulatory provisions for Second Runway Aiming Points operations (SRAP)] which PJ02 will also mature.
	APP ATC 115	Required	Yes	Approach ATC system to support second runway aiming point operations	
AO-0331	AERODROME-ATC-71	Required	Yes	Aerodrome ATC system to support Increased Glide slope operations	

	APP ATC 114	Required	Yes	Approach ATC system to support Increased Glide slope operations	Those ENs are both enabled by REG-0530 [Regulatory provisions for Increased Glide Slope operations (IGS)] which PJ02 will also mature.
AO-0321	AERODROME-ATC-72	Required	Yes	Aerodrome ATC system to support Adaptive Increased Glide slope operations	Those ENs are both enabled by REG-0528 [Regulatory provisions for Adaptive-Increased Glide Slope operations (A-IGS)] which PJ02 will also mature.
	APP ATC 113	Required	Yes	Approach ATC system to support Adaptive Increased Glide slope operations	
AO-0331	AERODROME-ATC-94	Required	Yes	Aerodrome ATC system to support IGS-to-SRAP operations	Those ENs are both enabled by REG-0533 [Regulatory provisions for Increased Glide Slope to Second Runway Aiming Point operations (IGS-to-SRAP)] which PJ02 will also mature.
	APP ATC 163	Required	Yes	Approach ATC system to support IGS-to-SRAP operations	

The main challenges of AO-0308, AO-0319, AO-0320, AO-0321 and AO-0331 will be:

- To design safe, cost effective and efficient visual aids supporting EAP
- Finalise the safety assessment of wake separation for EAP
- Refinement of flight guidance for slopes above 3.5°
- Achieve airspace Users buy-in considering the concept impact onto the flight operations

1.2.2.2.5 Static Pairwise Separations for Arrivals and Departures (AO-0306 and AO-0323)

The scope includes the optimisation of static pairwise separation matrixes for successive arrivals and departure. The development (i.e. regulation and associated safety cases) of a refined methodology for separation minima based on more categories or different categories for more adequacy to local airport environment depending on the traffic mix and the inclusion of new aircraft types in pairwise matrixes. The work will focus on regulatory enablers (enabling ATC system EN) to further optimise the benefits identified in Solution #02.01 at the end of wave 1 (see table below).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0306	AERODROME-ATC-42a	Required	Yes	Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information	Those ENs are both enabled by REG-0523 [Regulatory provisions for static pair-wise wake separation minima (S-PWS)] which PJ02 will also mature.
	APP ATC 118	Required	Yes	ATC System to Support Pairwise Separation in Specific Conditions based on static parameters	
AO-0323	AERODROME-ATC-42a	Required	Yes	Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information	

The main challenges of AO-0306 and AO-0323 will be:

- To define simple and easily applicable methodology for defining optimised 6 category scheme
- To define a simple maintenance process and analysis of the PWS matrix allowing inclusion of additional or new aircraft types in pairwise matrixes
- To collect the safety evidence for supporting the regulatory approval of the full PWS-D concept

1.2.2.2.6 Dynamic Wake Separation for Arrival and Departure (AO-0307 and AO-0324)

The scope includes the definition/refinement of criteria for defining real time, dynamic wake separation and also the criteria for suspension of the use of reduced minima for Arrival.

These criteria will be based the monitoring of wake turbulence risk using ground-based LIDAR/Radar also using advanced techniques as big data / machine learning.

The scope will also cover the definition of separation reduction for departure for a following aircraft either employing an early lateral displacement, differentiated rotation position and/or a steeper climb profile than the lead aircraft (e.g., between A380 and Heavy wake category lead aircraft and Medium and Light wake category follower aircraft) or based on weather-dependent early lateral displacement between leader and follower.

Enablers list will be frozen once V2 completed.

The main challenges of AO-0307 and AO-0324 will be:

- To turn LiDAR sensor use so far as off line validation system into an operational tool able to provide relevant and reliable information used for dynamic separation definition
- Collection of measured wake data to provide validated scenarios for a departure flight simulation campaign
- Definition of a viable operating method for employing wake avoidance based on differentiated rotation position and/or a steeper climb profile than the lead aircraft.

1.2.2.2.7 Airborne Spacing Monitoring under IFR (ATSAW - Spacing monitoring) (AUO-0504)

The scope includes Real Time Simulations of approaches performed on an integrated aircraft simulator connected to a traffic generator.

The separation to be considered by the flight crew will be provided by pseudo-controllers by voice or other communication means. The position and trajectory of the preceding aircraft will be simulated from a traffic generator.

Human factors will be analysed to validate the concept of airborne self-separation delivery and in particular the pilot-ATC communication.

Enablers list will be frozen once V2 completed.

The main challenges of AUO-0504 will be:

- Availability of ANSPs for such simulations (fall back is creation of a controller pool)
- The capacity of the flight crew to apply the procedure according to weather conditions (head up / head down)
- The clear definition of responsibility in terms of separation to fly the operations between the Air Traffic Control and the Flight Crew of follower flight

Enablers list will be frozen once V2 completed.

1.2.2.3 Problem Statement, Geographical spread and timescale

Legacy ICAO wake vortex separation rules were implemented over 40 years ago and have in some respect become outdated, resulting in States introducing their own local amendments. Today's ICAO separations (including RECAT) are still based on certified Maximum Take Off Mass (MTOM) and span allocating all aircraft into one of them. Because the separations are defined based on the worst case in each category, this leads to over conservative separations in many instances.

The geographical spread of these limitations corresponds to airports with Heavy traffic operating single or multiple runways in segregate or mixed-mode operation close to maximum runway capacity. For these airports the time scale of the limitation is generally observed on a daily basis during peak hours with some variation throughout the year as a function of the seasonal traffic pressure and mix. Wave 1 analyses have shown that it corresponds today to around 10 airports expected to increase to 20 in the coming years.

During peak hours all aircraft pairs, even if not constrained by any other separation standards (e.g., wake separations), should maintain runway separation for coping with runway occupancy time. That means that for airports with few or no Heavy aircraft imposing wake separation, increased throughput can only be achieved by the reduction of these runway separation minima.

The geographical spread of these limitations corresponds to all airports with runway capacity constraints either because of wake or because of runway occupancy time. The time scale of the limitation is also observed on a daily basis during peak hours. Wave 1 analyses have shown that it corresponds today to around 20 airports expected to increase to 30 in the coming years.

Furthermore today's arrival separation delivery leads to loss of efficiency and capacity due to the current granularity of separation rules and the uncertainties of aircraft parameters that need to be overcome to achieve full benefits. Meaning that all airports impacted by the constraints identified above will benefit from an optimised separation delivery tool.

The noise impact of aircraft flying ILS approaches is another major limitation that constrains operations especially during the night. The ILS glideslope is always close to 3-degree angle that requires aircraft to fly low above many populated areas and not always following trajectories that allow optimum flap setting and engine thrust for both consumption and noise. The geographical spread of this limitation is very large. Considering more constraining noise abatement procedure requirement, almost all major and regional airports could be impacted by the limitations described on a daily basis.

1.2.3 Solution 17 - Improved access to secondary airports

Description of topic and how addresses specific challenges and scope

1.2.3.1 Topics

The solution will address following aspects:

- Further improvement of runway operations at secondary airports in low visibility conditions through evolution of Alternative Ground Surveillance and dedicated set of Safety Nets (**SDM-0301** and **AO-0108**). This topic will utilize results from the SESAR2020 wave 1 works and will continue to evaluate camera use as primary sensor, in combination with existing surveillance equipment, for maximum efficiency. AGS and safety nets will further validate reliability of low-cost vehicle tracking. This topic considers secondary airports' capacity gain without significant investment.
- Aircraft capability to enable CAT II like approach operation provided by GNSS (SBAS) equipment and related procedures. It includes enhanced positioning for Localizer Precision with Vertical Guidance Approach based on Multiple Constellation / Multi frequency Space Based Augmentation System (SBAS) development and stabilized (**AO-0333**).
- On-board vision systems such as Combined Vision System (CVS) and Synthetic Vision Guidance System (SVGS) enabling advanced Equivalent visual approach and landing operation by using forward external

view topography provided by active sensor and combination of flight guidance display technology and high precision position assurance monitors (**AUO-0410** created via CR-02774).

1.2.3.2 Challenges and scope

1.2.3.2.1 Improved access into small airports in low visibility conditions (SDM-0301) and Airport Safety Nets for Controllers at Secondary Airports (AO-0108)

The scope of the work concentrates on further evaluation and validation of Alternative Ground Surveillance concept that enables better and more predictive operations at secondary airports. An ultimate focus will be put on further tuning of the system in order to achieve maximum availability in low visibility conditions, including evaluation of different sensors configurations as well as further tracker development.

Special focus will be put on HMI that will also include safety nets (following successful V2 validations in the framework of PJ03b SAFE project) designed for use at the secondary airport equipped with Alternative Ground Surveillance. The work focus in those OI steps will be on the following required ENs (see table below).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
SDM-0301	AERODROME-ATC-28b	Required	Yes	Surface movement control workstation Aerodrome Control Service in Alternative Ground Surveillance environment	Created via CR-02921
	AERODROME-ATC-75	Required	Yes	Remote Tower Module for provision of MET conditions reproduction	
AO-0108	AERODROME-ATC-03a	Required	Yes	Runway monitoring and conflict alerting (RMCA) system based on alternative aerodrome surveillance	
	AERODROME-ATC-06a	Required	Yes	Alternative aerodrome surveillance incorporating the function that detects Conflicting ATC Clearances (CATC) for runway operations	
	AERODROME-ATC-07a	Required	Yes	Alternative aerodrome surveillance incorporating the function that provides Conformance Monitoring Alerts for Controllers (CMAC) on the movement area	

The main challenges of Ground part will be
SDM-0301:

- produce further enhancements to video detection and picture analysis;
- extend a surveillance tracker to be used in camera-based surveillance system, including the video tracking algorithms;
- improve the reliability of tracking and resilience of video detection
- provide a minimum ground tracking service thanks to already existing air sensors that may have a ground coverage
- improvement of low cost vehicle tracking in secondary airports environment;
- further enhance the CWP dedicated to AGS;
- conduct evaluation of the different criteria, including weather minima to satisfy Regulator's measures for certification.

AO-0108:

- further improve the Safety Nets to enhance the CWP functions of AGS dedicated to ATS officers.
- #### 1.2.3.2.2 Improved Approach procedures into Secondary Airports in Low Visibility Conditions (AO-0333) and Equivalent Visual Approach and Landing operations providing improved resilience to LVC (AUO-0410)

The scope includes the development and validation of airborne concepts and means enabling continuation in the approach operation in cases when low visibility condition occurs and pilots are not allowed to continue in approach execution with respect to their ability and on-board equipment. The solution will focus on development and validation of

- LPV-100 capability supported by GNSS (SBAS) supporting and providing sufficient position performance capability. It will improve accessibility to secondary airports without ILS CAT II equipped runway in LVC.
- Vision systems
 - Combined Vision for Equivalent Visual Approach and Landing operations with active sensor will improving resilience to LVC by increasing Visual Advantage. It will be enabled by active sensor with advanced processing and will lead to improved performance compare to current available sensors.
 - Integration of SVGS features in Combine Vision System will enable to perform EFVS to land operation on approach performed with SVGS (operational credit with SVS on the instrument segment followed by operational credit with EFVS on the visual segment during the same approach).

- Synthetic Vision Guidance System for Equivalent Visual Landing operations using LPV or ILS CAT I guidance. It will leverage the potential of SVGS to ILS CAT I and LPV approach operation.

The work focus in those OI steps will be on the following required/optional ENs (see table below).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0333	A/C-01b	Required	Yes	Aircraft capability to support Multiple Constellation / Multiple Frequency SBAS LPV 100	
AUO-0410	A/C-23b4	Required	Yes	Combined Vision for Equivalent Visual Approach operations using active sensor	
	A/C-23b5	Optional	Yes	Combined Vision for Equivalent Visual Landing operations using active sensor	
	A/C-23b6	Optional	Yes	Combined Vision with SVGS	
	A/C-23a2	Optional	Yes	Synthetic Vision Guidance System for Equivalent Visual Landing operations using LPV or ILS CAT I guidance.	

The main challenges of airborne part will be:

AO-0333:

- To allow crew to perform approaches in low visibility conditions at secondary airports. These airports are typically not equipped with ILS CATII/III facilities. The solution will thus increase these airports' accessibility.

AUO-0410:

- To improve efficiency and availability of current equivalent visual landing operations in low visibility conditions by improving the performances of the existing enabler.
- To design and validate feasible visualization of active sensor data for equivalent visual operation
- To improve resiliency with integration of new enablers (for instance active sensor) in the existing CVS approach and landing operation

1.2.3.3 Problem Statement, Geographical spread and timescale

- Predictability at secondary airports is highly limited, mostly due to lack of infrastructure and adequate procedures targeting the reduction of limitations during the adverse weather conditions, especially the capability to handle operations in meteorological conditions below ILS CAT 1 minima. The limitation affects capacity of both secondary airport and the network through diversions, delays and cancellations of flights etc.
- The need for reliable tools, procedures and technical infrastructure, which will extend the possibility to use the secondary airports in LVP, ensure increased certainty of the service to be provided at concerned aerodromes. Work will focus on producing reliable and cost-effective solutions, allowing secondary airport to extend their operational readiness to handle operations below current CAT I minima (550m RVR / 60m ceiling).
- A combination of cockpit vision sensors, safe approach procedures with vertical guidance and automated ground services will be a key element to increase the Low Visibility Procedures operations at secondary airports. Reduced minima or cost effective air traffic services will benefit to a wider number of airspace users thus improve safety.
- Geographical spread corresponds to small/medium airports – secondary nodes, with majority of irregular operations, targeting approximate number of yearly movements around 50.000. These airports are normally less equipped, which prevents scheduled flight from operations, or constrains the scheduled traffic within limited period (depending of the equipment / service).
- Limitation's timescale materializes usually during the mornings or evenings in the spring or in the autumn season.

1.2.4 Solution 21 - Digital evolution of integrated surface management

Description of topic and how addresses specific challenges and scope

1.2.4.1 Topics

The Solution will address the following topics:

- Optimization of routing and planning to deliver more accurate taxi times, and minimize delays and controllers' workload. Consolidation of all the required inputs / constraints is done with the objective to consider potential conflicting situations when planning taxi routes. Timing information provided by airport sequencing tools (as AMAN and DMAN) will further contribute to the optimization of the planning process (AO-0224).
- The dynamic virtual block control concept integrated with data link service requires more investigation in order to optimise the efficiency of operations through automation (AO-0223-B).

- Data link service to ensure the exchange of clearances / instructions between controllers and flight crew. The main objective is to consolidate the set of instructions that produces relevant benefits when exchanged via data link. The operational utility to exchange other messages via data link as well as to determine the maximum latency value which is considered acceptable for operational use will be part of the assessment. The Data link service will be used also to ensure the exchange of VSB positions and status (**AUO-0308-B**).
- Data link service to ensure the exchange of clearances / instructions between controllers and vehicle drivers. A first set of instructions has been initially investigated in wave 1, the main objective here is to further assess any related potential constraints and performance issues. Following the work in wave 1 and in cooperation with the EUROCAE WG 78, standardisation of messages exchanged between ATCo and vehicle drivers will be addressed (**AO-0215**).
- Navigation and guidance supporting means using Airfield Ground Lighting and the consolidation of the so called "Follow-The-Greens" procedures on taxiways / runways. The validation of the operational usability of that procedure is proposed to be part of this solution (**AO-0222-B**).
- Guidance assistance to both pilots (**AUO-0603-B**) and vehicle drivers (**AO-0206**) by providing them with an Airport Moving Map integrating information about the surrounding traffic and all the relevant guidance instructions.
- Extension of Airport Safety Nets for Controllers on runways, taxiways and in the apron/stand/gate area as well as unauthorized / unidentified traffic thanks to detection of potential and actual conflicting situations, incursions and non-conformance to procedures or ATC clearances. Appropriate predictive indications and alerts are provided to the Controllers for any concerned mobiles and stationary traffic (**AO-0104-B**).

1.2.4.2 Challenges and scope

- 1.2.4.2.1 Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing (AO-0206) and Airport ATC provision of ground-related clearances and information to vehicle drivers via datalink (AO-0215)

The scope includes the development and validation of a system providing to Vehicle Drivers the display of dynamic traffic context information including status of runway and taxiways, obstacles and route, potentially by application of an airport moving map (AO-0206). This is a needed improvement to enhance guidance assistance to vehicle drivers operating on the airport maneuvering area under low visibility conditions.

The efficiency of airport surface operations is improved through the reduction of R/T use between Controllers and Vehicle drivers as well as Safety will benefit from the reduction of misunderstanding of clearances and information given by voice. Controllers and Vehicle Drivers will be allowed to exchange ground-related clearances and any relevant surface operation information through automated datalink (AO-0215). The work focus in those OI steps will be on the following required/optional ENs (see table below).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0206	AIRPORT-44	Required	Validate	Onboard vehicle display for taxi information and clearances, using common airport map database	no dependency Local to OI step
AO-0215	AERODROME-ATC-44	Required	Validate	Surface movement management tools updated to provide ground clearances and information to the vehicle driver	no dependency Local to OI step
	AIRPORT-01	Required	Validate	In-vehicle access to ground clearances and information	no dependency Local to OI step

The main challenges of AO-0206 and AO-0215 will be:

- The design, development and validation of enhanced taxi route planner functionality, such as ground route calculation and clearances management, including not only the management of air traffic but also an optimized and efficient control of airport vehicles, in both the apron and maneuvering area
- The design, development and validation of a data link messages exchange system allowing automated communication between ATCO and the vehicle drivers (e.g. tow order or proceed to clearance).

- 1.2.4.2.2 Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways) (AO-0222-B)

The scope includes the development of a Airfield Ground Lighting system through which mobiles will be guided along their cleared route, taking into account tactical decisions (made by the Apron Manager, Tower Ground Controller and Tower Runway Controller) and known constraints from the surface management system. The Airfield Ground Lighting infrastructure will switch automatically the taxiway centerline lights and stop bars accordingly for each mobile individually. The operational service shall be capable of automatically supporting a safe longitudinal and lateral spacing between mobiles and also managing priorities between mobiles on the aerodrome surface in all weather conditions.

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0222-B	AERODROME-ATC-07b	Required	Validate	A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area	To be validated by Solution 25
	AERODROME-ATC-61b	Required	Validate	Advanced surface guidance management services to process the automatic triggering of airport ground signs and lighting according to the route issued by ATC	no dependency Local to OI step

The main challenges of AO-0222-B will be:

- Definition of an advanced Airfield Ground Lighting functionality that would cover the management of priorities to ensure lateral separation between mobiles on the movement area in all weather conditions
- Provide pilot and on-board systems with ground routing information allowing the implementation of an advanced follow the green concept in the context of trajectory based operations

1.2.4.2.3 Enhanced Safety in LVP through use of Dynamic Virtual Block Control (AO-0223-B)

The scope includes the development and validation of the Fully Dynamic Virtual Block Control (FD-VBC) concept of operation. "Fully Dynamic Virtual Block Control" is a major step from procedural control towards automation supported operations under low visibility conditions. In low visibility conditions, the tower controller working positions are provided with Dynamic Virtual Stop Bars (VSB) to improve low visibility operations and enhance controllers' situational awareness. Virtual Stop Bars can become active when selected by the controller to reduce block-sizes once procedural control applies. This means that a moving map display in the cockpit must be able to show these positions to the flight crew once they become active. As a consequence, both Tower Controller and Flight Crew have the same level of situation awareness and this makes the airport system resilient when low visibility procedures are in place.

Additional controller safety nets shall be available to alert in case of violations of Stop Bars (including Dynamic Virtual Stop Bars) and to monitor aircraft if any unauthorized movement should occur (Watch Dog).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0223-B	AERODROME-ATC-86	Required	Validate	Workstation equipped with "bubble separation" or "spacing" tools for monitoring the reduction of spacing between two aircraft	no dependency Local to OI step

The main challenges of AO-0223-B will be:

- Definition and Validation of methodology and operational procedures enabling the DVBC concept transferred towards detailed system specification and deployment phase
- Quantification of the Benefits associated to the implementation of the DVBC concept

1.2.4.2.4 Advanced Automated Assistance to Controller for Surface Movement Planning and Routing (AO-0224), Datalink Services used for Provision of Ground-related Clearances and Information for Step 2 (AUO-0308-B) and Enhanced Guidance Assistance to Aircraft on the Airport Surface Combined with Routing in Step 2 (AUO-0603-B)

The scope of the activities proposed to address this group of OI Steps includes the development of a system providing the controller with the most suitable taxi route. This route is calculated by:

- optimizing the selected criteria (e.g. delay, distance, emissions or a combination thereof),
- and conforming to the planning, ground rules and known operational constraints,
- and taking into account potential conflicting situations with other mobiles.

The development and validation of a data link system allowing communication exchanges between Controllers and Flight Crew in a trajectory based operations context is part of the scope as well. Flight Crews and Controllers will be allowed to exchange ground-related clearances and any relevant surface operation information through datalink.

In addition to that, the solution will also provide the Flight Crew with a system displaying the airport layout (i.e. taxiways, runways, fixed obstacles), the aircraft's own position, the route (to runway or stand), the taxi clearances (as issued by ATC) and the status of runways and taxiways.

The achievement of the OI Steps will allow airports with complex layout to improve the allocation of taxi routes to both aircraft and vehicles under ATC by supporting the controller with a tool that automatically plans taxi routes and makes them known to the ATC system, provides the A-SMGCS Guidance function, supports the sequencing of departures flights at the runway and triggers conformance monitoring alerts.

Expected benefits are an increased situational awareness of both controllers and flight crews, particularly in LVPs, and an improved predictability of ground movements thanks to the computation of more accurate and reliable estimated taxi times.

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0224	AERODROME-ATC-12b	Required	Validate	Provision of optimised taxi routes for mobiles on the movement area	no dependency
	AERODROME-ATC-23a	Optional		Enhanced A-SMGCS Core Surveillance function for new A-SMGCS Services	Local to OI step
AUO-0308-B	A/C-31a	Required	Use	Controller pilot data link communication (CPDLC) compliant with ATN baseline 2 (FANS 3/C)	Validated in SESAR1 (#23)
	AERODROME-ATC-02b	Required	Validate	Surface movement management tools updated to provide the data-link information to the pilot in Step 2	no dependency
	CTE-C02d	Optional		New Airport Datalink technology (AEROMACS)	Local to OI step
AUO-0603-B	A/C-24	Required	Use	Airport moving map and own aircraft position display in cockpit	Pre-SESAR
	A/C-31a	Required	Use	Controller pilot data link communication (CPDLC) compliant with ATN baseline 2 (FANS 3/C)	Validated in SESAR1 (#23)
	A/C-42a	Required	Validate	On-board graphical display of taxi clearance using common air/ground airport database	Also in PJ03b-03
	A/C-42c	Required	Validate	Onboard management of dynamic update of runway/taxiway status	partially validated in SESAR1 (#26)]
	CTE-C02d	Optional		New Airport Datalink technology (AEROMACS)	no dependency
	METEO-03c	Optional		Provision and monitoring of real-time airport weather information, Step 2	Local to OI step
	METEO-04c	Optional		Generate and provide MET information relevant for Airport and approach related operations, Step 2	Validated in SESAR1 (#102)
	REG-0200	Optional		Safety Targets in Relation to Reductions of Runway Incursions	Should be validated

**In green, the enabler already V3 or optional not addressed by the project*

The main challenges of the OI Steps AO-0224, AUO-0308-B and AUO-0603-B will be:

- The development of enhanced Routing and Guidance services based on combined use of automated planning support and automated guidance providing continuous, de-conflicting, routing and scheduling of both aircraft and ground vehicles
- To quantify the benefits deriving from the implementation of the OI in terms of reduced delays, optimised conflict-free taxi routes avoiding any potential deadlocks
- Adaptation of the datalink service used for provision of ground-related clearances and information (e.g. target times) to a trajectory based operations environment
- Design of a complete enhanced guidance assistance tool to Flight Crews on the airport surface

1.2.4.2.5 Extended Airport Safety Nets for Controllers at A-SMGCS Airports (AO-0104-B)

The scope includes the further developments of improved Airport Safety Nets at A-SMGCS Airports thanks to better detection of potential and actual conflicting situations, incursions and non-conformance to procedures or ATC clearances, involving mobiles and stationary traffic on runways, taxiways and in the apron/stand/gate area. Detection of unauthorized / unidentified traffic, as well as appropriate predictive indications and alerts to be provided to the Controllers are also part of the scope.

The advanced set of Conformance Monitoring Alerts for Controllers (CMAC) and the Conflicting ATC Clearances (CATC) detection tool incorporated into the A-SMGCS shall be extended on the entire airport surface, including aprons and parking stand/gates.

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0104-B	AERODROME-ATC-06b	Required	Validate	A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface	no dependency
	AERODROME-ATC-07b	Required	Validate	A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area	Local to OI step
	AERODROME-ATC-61b	Optional	Use	Advanced surface guidance management services to process the automatic triggering of airport ground signs and lighting according to the route issued by ATC	Also in PJ03a-01
	AIMS-16	Optional		Electronic Terrain and Obstacle Data (TOD)	Validated in PJ03a-01

**In green, the enabler already V3 or optional not addressed by the project*

The main challenges of AO-0104-B will be:

- Develop and validate CATC and CMAC for a wide number of airport scenarios with complex layout and high traffic
- Optimize the adjustment workflow to fine-tune the CATC detection parameters
- Identify potential issues related to acceptance of the Safety Support Tools and assess training needs (HP-related transition factors)
- Investigate the impact of CATC detection and alerting on the human actors
- Assess potential training methods to familiarize the controllers with the Safety Support Tools

1.2.4.3 Problem Statement, Geographical spread and timescale

At most of European airports concerned stakeholder are individually handling arriving and departing movements as separate processes, resulting in an inefficient allocation of overall airport resources with a negative impact on the smoothness of the traffic flow. The need for a better sharing of common information is even more crucial in low visibility conditions when managing airport surface ground operations, which are safety critical and potentially leading to a dramatic reduction of the airport capacity. The use of voice as the

main communication means, with the potential risk of misunderstanding and frequency congestion, is another factor limiting the efficiency and safety of operations at airports.

All of the above can be sensibly enhanced by optimising the use of resources and improving the predictability of events, which is the objective of this solution. It focuses especially on taxiway operations where a more accurate prediction of taxi times supported by the display and sharing of common information will also improve the ability to react to sudden constraints. The geographical spread of these limitations corresponds to airports with medium and complex layout targeting medium to heavy traffic, that could be roughly estimated are the most of top 100 European Airports. For these airports the time scale of the limitation is observed on a daily basis, especially during peak hours.

The implementation of Dynamic Virtual Block Control by means of Virtual Stop Bars (VSB), as well as the Data Link for communications and the common awareness of VSB status, will ensure a better efficiency of taxi procedures in adverse weather conditions. Situational awareness will also benefit from the exchange of data link clearances/instructions between controllers and pilots/vehicle drivers. In addition to the expected reduction of misunderstandings when using radiotelephony, the implementation of data link services and Follow-the-Greens procedures will have a positive impact on R/T frequency congestion and workload. According to statistics nearly 50 of the top 100 European Airports are affected by low visibility conditions for a number of days per year.

A safe longitudinal and lateral spacing between mobiles, in all weather conditions will be ensured on the aerodrome surface, with enhanced monitoring tools (Conflicting ATC Clearances – CATC, Conformance Monitoring Alerts for Controllers – CMAC) alerting in case of conflict/deviations.

1.2.5 Solution 25 - Safety support tools for avoiding runway excursions

Description of topic and how addresses specific challenges and scope

1.2.5.1 Topics

Runway excursions represent the most frequent accident category for worldwide accidents for the 2004-2009 period (cf. the 2004-2009 Runway Excursions Analysis in the IATA Safety Report 2015 (Issued April 2015, 51st Edition)). The risk of a runway excursion is increased by wet and contaminated runways, in combination with gusts or strong cross or tail winds.

The Solution will provide the Airport Operator, Air Traffic Controller, Airline Operation Center and flight crews with objective and synthetic elements about runway surface condition (AUO-0606, AO-0216 and AO-0107) for the later to make the right decisions in the preparation and execution of take-off, approach, and landing phases preventing runway excursion (AUO-0616).

1.2.5.2 challenges and scope

1.2.5.2.1 Improved Awareness of Runway Friction Evolution (AUO-0606)

The evolution of runway surface condition (measured by Runway condition awareness management Ground system) can be continuously monitored at the airport through the transmission either of a computed braking action calculated by on-board system (by analysis of braking performances on the part of the runway on which a landing aircraft has rolled) or of the observed contamination (by computer vision means).

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AUO-0606	A/C-64	Required	Yes	Broadcasted Runway Friction data	To be used in AO-0216/ AERODROME-ATC-47 in the solution
	A/C-84	Required	Yes	Braking action computation function in on-board braking action computation system	To be used in AUO-0616/A/C-74
	A/C-85	Optional	Yes	Communication datalink supporting aircraft-airport exchange of information (aircraft side)	No dependency – Local to OI step
	A/C-88	Optional	Yes	Runway contamination observation through aircraft computer vision equipment	No dependency – Local to OI step (created via CR-03059)

The main challenges of AUO-0606 will be:

- To validate the computation of braking action per runway segments (runway split into three segments)
- To validate, from on-board aircraft computer vision equipment, the runway contamination information assessment to be shared with airport operator

1.2.5.2.2 Improved Safety with Better Prevention of Runway Excursions for Pilots (AUO-0616)

During wave 1, development concerned an on-board Runway Overrun Awareness and Alerting System (ROAAS) to alert the flight crew if a risk of runway overrun occurs during the final approach and landing run. This system is currently deployed on airliners and V2 validation proved the ROAAS was also applicable to business aircraft. In wave 2, the Solution will extend the concept, considering current and predicted RWYCC,

- On landing preparation, and continuously during the approach until final, considering any RWYCC or aircraft parameters update and 4D trajectory;
- After touchdown, once braking devices are engaged and runway surface friction assessed, to adapt the deceleration method to the remaining distance available;
- During pre-Flight and Take-off phase: by integrating runway surface condition in the Take-Off Monitoring System used by flight crew;
- In order to foster digitalization and further automation on-board, the Solution may use computer vision to detect incorrect trajectory.

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AUO-0616	A/C-73	Required	No	Energy monitoring system during approach and landing to avoid runway excursion for dry or wet runway	Validated in wave 1
	A/C-74	Optional	Yes	Energy monitoring system during approach and landing to avoid runway excursion for any kind of contamination on runway surface	Could use Braking action computation function of AUO-0606 to adjust landing performance assessment
	A/C-75	Required	Yes	Take-off monitoring system to avoid runway excursion	No dependency – Local to OI step
	A/C-89	Optional	Yes	Monitoring of aircraft trajectory through aircraft computer vision equipment	No dependency – Local to OI step (created via CR-03060)
	AIMS-16	Required	Use	Electronic Terrain and Obstacle Data (TOD)	Validated in wave 1
	AIMS-23	Required	Use	Enhanced digital data chain to ensure Aeronautical Information data provision to meet full 4D trajectory management requirements	

*In green, the enabler already V3 or optional not addressed by the project

The main challenges of AUO-0616 will be:

- to develop the take-off monitoring system;
- To extend the ROAAS concept on landing preparation phase and after touchdown, by adjusting the estimated end of runway roll to the encountered runway friction.

1.2.5.2.3 Enhanced Runway Condition Awareness for airport operator (AO-0216) and for controllers (AO-0107)

The airport operator is responsible for the physical conditions on the aerodrome. To provide the flight crews with objective and synthetic elements for them to make the right decisions in the preparation and execution of take-off, approach, and landing phases, the airport operator shall assess the runway surface condition, by providing information on contamination and on current and when possible predicted Runway Condition Code (RWYCC) to air traffic controllers, for them to pass information to arriving and departing aircraft. The runway surface condition can also interest other stakeholders - e.g. APOC and AOC- to enhance their situational awareness.

OI	Enabler	Required / Optional	Covered by PJ02	Enabler Title	V3 Dependency / Comments
AO-0216	AERODROME-ATC26	Optional	Yes	Runway condition awareness management system based on runway sensors	
	AERODROME-ATC32	Required	Yes	Runway condition awareness management system based on weather-based runway condition model	
	AERODROME-ATC47	Optional	Yes	Airport ATC Subsystem to incorporate aircraft broadcasted runway friction data	
	AERODROME-ATC95	Optional	Yes	Runway condition awareness management system based on surveillance	
	AERODROME-ATC96	Optional	Yes	Runway condition awareness management system based on braking action data reported by flight crew	
	AERODROME-ATC97	Optional	Yes	Runway condition awareness management system based on manual assessment of contamination	
	AERODROME-ATC98	Optional	Yes	Runway condition awareness management system providing predicted runway surface information	
	AERODROME-ATC99	Optional	Yes	Runway condition awareness management system based on mobile sensors	Creation requested via CR-03063
AO-0107	AIRPORT-55	Optional	Yes	Communication datalink supporting aircraft-airport exchange of information (airport side)	
	AERODROME-ATC31	Required	Yes	Surface movement control workstation equipped with tools to better prevent runway excursions	
	METEO-03c	Required	Use	Provision and monitoring of real-time airport weather information, Step 2	
	METEO-04c	Required	Use	Generate and provide MET information relevant for Airport and approach related operations, Step 2	

The main challenges of AO-0216 and AO-0107 will be:

- To input aircraft broadcasted runway friction data in the runway surface condition assessment process
- To develop SWIM services to disseminate runway surface condition to any interested stakeholders
- To detail working method of each stakeholders around the new runway surface condition information

1.2.5.3 Problem Statement, Geographical spread and timescale

Applying the ICAO Global Reporting Format (ICAO GRF) under current operating methods will need disruptive runway inspections each time a Runway Condition Code (RWYCC) value will need reassessment. The Solution will provide the comprehensive approach to increase efficiency of continuous assessment of the runway condition with means based on weather data, range of sensors (runway surface sensors to identify the runway contaminant type and depth, airborne sensors - braking action computing function, computer vision), AIREP, landing trajectory and deceleration analysis (based on surveillance data).

By adding forecast weather data, a prediction can be made on the evolution of the runway condition, which will support the airport operator decision-making process regarding runway decontamination.

The geographical spread of the solution corresponds to any location, any timescale, for any airport operational environment. By increasing resilience to adverse weather situation, the solution is especially interesting in airport where adverse weather situation are frequent.

By definition, the airborne part of the solution provides benefit in runway excursion risks mitigation for any airport type and location.

1.3 Concept and methodology

Solutions described in the proposal address very distinct improvements to overall airport airside operations. The existing synergies and dependencies are described in this section. Furthermore, whilst each solution represents standalone improvements, initiated in separate Wave 1 projects (PJ03a, PJ03b and PJ02) they have been consolidated the Wave 2 Project 02.

1.3.1 Concept

Improving runway throughput is hampered by constraints such as wake vortex, runway occupancy, complex airport surface configuration, meteorology and environmental issues including noise.

To improve the efficiency and resilience of arrival and departure operations at capacity constrained airports and access to secondary airports, the concept specifically addresses human, technical, procedural and performance aspects of the following proposed improvements:

- Evolution of separation minima for increased runway throughput
- Digital evolution of integrated surface management
- Advanced geometric GNSS based procedures in the TMA
- Improved access to secondary airports
- Safety support tools for avoiding runway excursions

All validation activities conducted will include Interdisciplinary work between operational experts, system and software engineers, safety and human performance experts and will build on stakeholders and airspace users, pilot and controllers knowledge through their participation in all real time simulations.

National or international research and innovation activities, which will be linked with the SESAR solutions, are described into point (b) below.

Solution 4 - Advanced geometric GNSS based procedures in the TMA

The Solution will address enhancement for the Terminal Manoeuvring Area using more efficient curved operation.

The arrival phase is linked to novel GNSS technology (GBAS, SBAS, MC/MF) and using advanced PBN functions from the beginning of the approach phase, including the usage of GNSS geometric altitude for vertical guidance, and the need to cater for a mixed mode environment.

For this concept, two different traffic merge points will typically appear for each runway end. One located where the straight-in arrivals are intercepting the localizer of the ILS and another one where the curved approach intercepts the extended centre line of the runway. Today there are no sufficient support tools available for ATC to create a stable and efficient sequence based on the two merge points. The development of a system support tool for ATC enabling efficient mixed mode operation in all traffic volumes appears to be an important system enabler. Without an adequate support tool, more separation margin is required leading to less efficient arriving sequence (and lower runway throughput).

This will also require development of new airspace design concepts that use tight RNP containment in order to ensure de-confliction by design in order to support ATCOs in monitoring that separation is maintained for handling the merge of traffic performing a curved approach with traffic performing a straight-in approach. This will enable greater usage of CDO.

For the departure phase, by allowing increased flexibility in departure procedure design and using airborne capabilities to greatest extent possible, significant improvement in environmental performance and runway throughput is expected.

Solution 14 - Evolution of separation minima for increased runway throughput

The Solution will address refinement of wake turbulence separation minima between arrivals or between departures with an aim to increase the runway throughput. According to various operational conditions (e.g. wind at the airport, use of Enhanced Arrival Procedures, etc.) and/or the pair of aircraft involved, the most

constraining minima to be applied will be determined on the basis of many possible elements (e.g. weather-dependent, static pair-wise, dynamic pair-wise, ROT). The concept of operations will also explore the case where Dynamic Adjustment of Spacing Depending on Wake Turbulences could be delegated to the flight crew and will continue to develop ATCO support tool for better delivery of separations.

Solution 17 - Improved access to secondary airports

The concept of operations aims at enhancing availability and accessibility of secondary airports, which are currently suffering from limited infrastructure both from the air and ground perspective, in order to handle more operations in low visibility conditions, and therefore improving capacity.

From a ground perspective, the concept proposes further improvements on the Alternative Ground Surveillance that brings capacity increase at secondary airports in adverse weather conditions through better predictability and increased safety of the runway situation, not excluding other potential use (e.g. at primary airports to support blind-spots, when there is no business case for SMR). The concept also address flexibility of ATS by including both ATC and A-FIS requirements; targeting a cost-efficient and flexible ATS provision.

From an airborne perspective, the concept will address new LPV-100 capability and vision system aspects. The LPV-100 concept will use GNSS (SBAS equipment) and will also focus on related procedures. The vision systems concepts will address innovative concepts e.g. active sensor supporting CVS approach operation, EFVS on LPV approaches, SVGS operation with HUD and future SVGS approaches, which will improve resilience to adverse weather conditions of approach operations, and therefore improving availability and accessibility to secondary airports and increasing network capacity.

Solution 21 - Digital evolution of integrated surface management

The extension of the A-SMGCS routing functions will better support tactical conflict management in the taxi phase. Optimised Routing and planning will deliver more accurate taxi times, improve predictability, minimize delays and controllers' workload. The conflict management will be supported with input from airport A-CDM platform and other sequencing tools in order to support resolution of conflicts. These functions will make use of enhanced systems to increase automation for ATC in tower ground positions.

The exchange of information between controllers and pilots / vehicle drivers will be improved with the use of data link services. Efficiency as well as Safety and resilience in low visibility conditions will also benefit from the implementation of Dynamic Virtual Block Control by means of Virtual Stop Bar. Conflicting ATC Clearances (CATC) and Conformance Monitoring Alerts for Controllers (CMAC) alerting functions will cover the entire airport surface ensuring an adequate level of Safety under all weather conditions.

Solution 25 - Safety support tools for avoiding runway excursions

The concept addresses procedures to detect, prevent and alert on risks of runway excursions for pilots, airport operators and controllers. It will provide the flight crew with more accurate and harmonised information, supported by systems and procedures. Synchronised air-ground information exchange about runway surface condition, including current and short-term forecasts, will allow better preparation and execution of take-offs and landings.

Detailed concept of PJ.02-25 will also focus on the following elements:

- Departure: to support flight crew in their take-off performance assessment by integration of runway surface condition with existing take-off monitoring system and associated procedures.
- Arrival: to support flight crew in their landing performance assessment.
- Avionics: computer vision support to detect incorrect trajectory and runway surface contamination for mitigation of runway excursion.
- Ground equipment: runway embedded sensors (used in wave 1) may be supplied by new types of sensors (e.g. mobile sensors to assess more accurately percentage of runway surface covered by contaminant).

1.3.2 Methodology

1.3.2.1 Solution 4 - Advanced geometric GNSS based procedures in the TMA

1.3.2.1.1 Deviation from the SPD

The following OI Steps will not be covered in Wave 2:

- AO-0312- Increased Runway Throughput by reducing separation distance defining CSPR
- AO-0322 - Enhanced Arrival procedures using double slope approach

These two OI Steps are considered “potential candidates” in SESAR Joint Undertaking H2020-SESAR-2019-1-IR VLD WAVE 2 Call Technical Specifications, thus considered optional and not covered by Solution 4.

1.3.2.1.2 Initial maturity level and the target maturity level for the solution:

- The initial maturity level is V1 for all the considered OI Steps of Solution 4, and the objective is to target V2 maturity level by the end of SESAR Wave 2.

1.3.2.1.3 List the outstanding R&D needs:

1.3.2.1.3.1 AOM-0607 "Enhanced Terminal Area for efficient curved operation"

- Study the application of advanced GNSS procedures extended to TMA.
- Mitigate high and low temperature effects on the vertical path by using GNSS based altitude during the approach phase.
- Investigate cockpit altitude display requirements for both high and low temperature conditions.
- Demonstrate operational benefits (safety, flight efficiency and flight crew workload) of full 3D curved operations in all meteorological conditions.
- Analyse feasibility of multiple 3D curved procedures for independent parallel approaches; identify requirements for runway layout (required distance between runways) and operational procedures taking into account existing standards (ICAO PANS-ATM (Doc 4444), ICAO PANS-OPS (Doc 8168), and ICAO SOIR (Doc 9643)) but also explore further improvements to the existing ICAO standards
- Identify minimum and maximum turn radii in subsequent flight segments to facilitate early curved departures with gradually increasing bank angle ensuring safety and aircraft stability at low altitude – cross link with existing design criteria and propose improvements to future design criteria's (ICAO PANS-OPS (Doc 8168) and ICAO RNP AR Procedure Design Manual (Doc 9905)).
- Demonstrate the feasibility of early curved departure procedures with subsequent turn radii and increasing bank angles by means of advanced flight simulations and post data analysis, analysing the accuracy and the stability of the trajectories, identify requirements in the navigation specifications and procedure design domain.
- Assess the impact on avionics of advanced GNSS operations in the TMA
- Assess pro and cons of transitioning between different types of navigation modes (e.g. RNP to xLS) versus maintaining one single navigation mode (e.g. RNP AR) for curved 3D approaches.
- Define ground system support tools requirements from an ATCO perspective for curved 3D approach operations.

1.3.2.1.3.2 AOM-0606 "Enhanced Parallel Approach Operations using PBN/RNP transitions to xLS "

- To determine how this novel Operational Concept can be further optimised (ground and air), compared to today's baseline scenario.
- What system support tools requirements are required from an ATCO perspective.
- Which are the possible PBN navigation specifications that could be considered.

1.3.2.1.3.3 AOM-0608 "Enhanced Parallel Approach Operations using PBN/RNP transitions to RNP (for at least one runway)"

- To determine the operational requirements to mix this concept with other operation.

1.3.2.1.3.4 AO-0313 "More flexible SID design by reducing divergence angle between independent departures"

- Evaluation of the impact on parallel runway operations and associated runway throughput will a Concept with reduced divergence angle have.
- Evaluation of the environmental impact will reduced divergence angles have.
- Evaluation of the impact on parallel runway operations and associated runway throughput will a Concept with departure with early turns have.
- Evaluation of the environmental impact will departures with early turn angles have.

1.3.2.1.4 Validation methods, techniques and tools

LFV/COOPANS will plan, organise and execute a Real Time Simulation (**Exercise 1**) at their premises in Sweden. This RTS will focus on operational requirements, ATCO needs and the information required to be shared amongst the various stakeholders, to enable advanced curved operations.

- Validate the intended ground based system support tool to enable advanced curved operations in the TMA.
- Collect feedback from participating ATCOs.
- Determine operational requirements from upstream sectors to manage a complex operational TMA environment.

THALES AIR SYS will contribute to the validation activities conducted by LFV/COOPANS by developing ATC components (AMAN, WVAS) integrated in the Ground ATC simulation platform supporting the RTS.

EUROCONTROL will organise Real Time Simulations (**Exercise 2**) using professional Level D flight simulators to demonstrate V2 level of maturity of the following applications:

Stable and efficient curved 3D operations mitigating the negative effects of both high and low temperatures on the vertical path, when using GNSS geometric altitude during approach.

- Stable and safe early curved departure operations with bank angles shallowly increasing with altitude (using subsequent turn radii), allowing earlier initiation of the turn with potentials for increased runway throughput and increased flexibility in departure procedure design.
- Possible cockpit integrations and impact on existing avionics.
- Flight Crew procedures.

Swed (SEAC2020) will be responsible for a Fast Time Simulation (**Exercise 3**), covering airports aspects of the proposed Concept of Operations, with the high level objective to determine any changes in runway throughput of the newly proposed Concepts, compared to today's baseline operational scenario.

The objective is to create a general simulation model for runway usage, with the use of the simulation program CAST. CAST is an airport specific modular platform, which can simulate aircraft traffic and process flows. The CAST simulation program is well known within the industry and is a product, based on development and cooperation amongst several partners, such as EUROCONTROL, BAA, AIRBUS/Ariane amongst others. The high level objective is to reach a V2 maturity level at the end of Wave 2.

The following objectives are planned to be conducted during the validation activity:

- Create a Fast Time Simulation model for the intended operations.
- Perform Fast Time Simulations with and without advanced curved operations.
- Evaluate the runway throughput using Fast Time Simulation;
 - With current operations as baseline scenario.
 - With the introduction on advanced curved operations as a future operational scenario.

The created model (used for the Swed (SEAC2020) organised FTS) should be dynamic and the user should be able to do choose percentage of mixed mode equipage, i.e. percentage of traffic capable of flying curved operations. It should also be possible to choose if one or two parallel runways are to be considered operative.

THALES Avionics will organise a Real Time Simulation (**Exercise 4**) aiming at the validation of the concept, using FMS prototype implementing the Baro VNAV to Geometric VNAV transition. Objective is to demonstrate V2 level of maturity for the definition of the optimal Transition management from an avionics perspective

The following objectives are planned to be conducted during the validation activity:

- Study and define the transition law and management for the intended operations.
- Implement the transition law inside the FMS prototype.
- Perform Real Time Simulations of advanced curved approach operations.
- Evaluate the benefits of the transition for guidance continuity between RNP phase and xLS phase;
 - With Baro VNAV guidance on advanced curved operations as baseline scenario.
 - With the introduction on Baro VNAV to geometric VNAV transition during advanced curved approach operations as a future operational scenario.
-

1.3.2.1.5 Validation scenarios

There are two main scenarios planned to be used by the various partners for the different validations:

- Medium complexity and medium density unconstrained TMA environment and parallel runways to focus on advanced curved operation in arrival and departure phase.
- An airport in challenging terrain environment, including cold temperatures, leading to challenging obstacle clearance conditions when usage of GNSS geometric altitude is considered.

The second scenario is linked to validation activities of usage of GNSS geometric altitude throughout a complete meteorological envelope (temperature and wind).

1.3.2.1.6 Sequence of validation activities

For Enhanced Parallel Approach Operations using PBN/RNP transitions to xLS (AOM-0606), Enhanced Terminal Area for efficient curved operation (AOM-0607) and Enhanced Parallel Approach Operations using PBN/RNP transitions to RNP (for at least one runway) (AOM-0608).

- Q4/2021-Q2/2022 RTS - **Exercise 1**
- Q3-4/2021 RTS - **Exercise 2**
- Q2/2021 FTS - **Exercise 3**
- Q4/2021 RTS - **Exercise 4**

For More flexible SID design by reducing divergence angle between independent departures (AO-0313)

- Q3-4/2021 RTS - **Exercise 2**
- Q2/2021 FTS - **Exercise 3**

1.3.2.1.7

- Outcomes of SESAR 1 project 09.09, 05.06.03, 06.08.05, 06.08.08 and SESAR 2020 Wave 1 PJ.02.11 are considered as predecessor of AOM-0607. In particular the OSIED, SPR, INTEROP for enhanced arrival procedures and reports from previous exercises will be used as a baseline to further elaborate the concept as well as the requirements and benefits and to define the setup of the V2 level validation.
- Solution 4 does not have any formal dependencies on other Wave 2 Projects/Solutions, however a relationship in the form of two-way information sharing and awareness of the Solution's concept/progress to ensure alignment could be beneficial with:

PJ.02 Solution 14 - Evolution of separation minima for increased runway throughput

PJ.01 Solution 1 - Next generation AMAN for 4D environment

PJ.01 Solution 8 - Dynamic E-TMA for Advanced Continuous Climb and Descent Operations and improved Arrival and Departure Operations

1.3.2.1.8 Main assumptions

- The OSIED/SPR/INTEROP from SESAR 2020 Wave 1 PJ.02.11, which is at V1 level, will be the baseline for Solution 2, to reach V2 at the end of Wave 2.

1.3.2.1.9 Relevant national or international research

- EUROCONTROL/FAA International GBAS Working Group (IGWG)
- RAISG (EUROCONTROL)
- LATO (EUROCONTROL)
- PBN-SG (ICAO)
- GT-PBN (French Civil Aviation)

1.3.2.2 *Solution 14 - Evolution of separation minima for increased runway throughput*

1.3.2.2.1 Deviation from the SPD

- Weather dependent separation reduction for arrival will be finalised at V3 and covered into Dynamic separation
- Dynamic separation for departure will be covered by dynamically using trajectory prediction like rotation point, early turn and climb profile.
- Rotation point and climb profile will be merged and covered into Dynamic separation
- AUO- 0505: Improved air safety using data exchange via e.g. ADS-B for Wake Turbulence prediction will not be covered because, presently, the consortium doesn't see any technical solution nor breakthrough in technology or definition of the needs that would allow to define a work plan.
- TS-0312 - Increased runway capacity through allowance of simultaneous runway occupancy (only for departures) will not be covered.

1.3.2.2.2 Initial maturity level and the target maturity level for the solution:

- **A0-0307 and AO-0324** of solution 14 are starting V1 maturity level based on the fact that Static Pair Wise Separation when used with Time Based are already dynamically applied as a function of aircraft speed profile and wind. The proof of concept (V1) can therefore be considered as achieved. Validation of A0-0307 and AO-0324 will therefore target completing **V2**.
- **AO-0335** of solution 14 are starting V1 maturity level based on the fact that Safe Cloud project already demonstrated that runway occupancy time, runway exit point, rolling distance can dynamically be predicted. The proof of concept (V1) can therefore be considered as achieved. Validation of **AO-0335** will therefore target completing **V2**.
- Validation of **AO-0336** is a new concept and will start from V1 based on the fact that the BTV function (Brake to Vacate) already demonstrated the in-board feasibility of dynamically calculating the landing deceleration profile for a targeted Runway exit. Validation of AO-0336 will therefore target completing **V2**.

- **AO-0334 and AO-0315** of solution 14 have completed V1 maturity level based on the fact that AO-0328 and AO-0329 already validated delivery of separation at V3. The AO-0334 and AO-0315 will be an evolution of these 2 OI Steps and will benefit from the work conducted on AO-0328 and AO-0329. The proof of concept (V1) can therefore be considered as achieved. Validation of AO-0334 and AO-0315 will therefore target completing **V2**.
- **AO-0308, AO-0319, AO-0320, AO-0321, AO-0331** will all target completing **V3** maturity since V2 was achieved in previous SESAR wave.
- **AO-0306 and AO-0323** S-PWS are already **V3**, the work will consist in supporting the safety evidences for the regulatory approval, the refinement for further benefits increase and the consolidation allowing to facilitate deployment that correspond to optional regulatory enablers **REG-0523** “Regulatory provisions for static pair-wise wake separation minima (S-PWS)”.
- **AO-0332** will not be covered with further validation exercises however the specification will be developed as part of the support to regulation work of the project..
- Validation of **AUO-0504** is a new concept and will therefore target completing **V2**.

1.3.2.2.3 List the outstanding R&D needs:

1.3.2.2.3.1 *Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival and departure (AO-0334 and AO-0315)*

- Development of ML/BD model for prediction of aircraft speed profile, rolling distance, departure trajectory and climb rate...
- Development of ML/BD model continuous adaptation of the target indicators in order to replicate human adaptive behaviour to evolutions of aircraft mix or even patterns of aircraft behaviour
- Development of wind now-casting / forecasting algorithm
- Development of the downlinking of the aircraft parameters and their integration in the tool
- Definition of the accuracy, reliability and integrity of downlinked aircraft parameters

1.3.2.2.3.2 *Dynamic Pairwise Runway Separations for Arrivals (based on ground information) (AO-0335)*

- Advanced definition of runway occupancy time
- Development of model for prediction of runway occupancy time, runway exit point, rolling distance of departing aircraft
- Development of ML/BD model for prediction of runway occupancy time, runway exit point, rolling distance of departing aircraft
- Automatic monitoring and maintenance of aircraft ROT based on local measurements

1.3.2.2.3.3 *Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (AO-0336)*

- Development of an Arrival ROT calculation from on-board data and pilot braking strategy (aircraft equipped or not of specific braking mode) and downlink to ATC
- Development of a Departure ROT calculation (brake release to lift-off) and departure climb profiles from on-board data and pilot take-off strategy and downlink to ATC
- Quantify the benefits of reduced ROT on runway throughput (arrival only for segregated runway / departure + arrival for mixed mode runway), using AirTop platform

1.3.2.2.3.4 *Enhanced Approach Procedures (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)*

- Definition of needed and acceptable visual aids for materialising glide (PAPI) and threshold (SRAP, IGS-to-SRAP)
- Analyse vertical variability of trajectory for different navigation technologies and aircraft types
- Finalise wake separation design as a function of procedure flow, aircraft category and navigation system used

1.3.2.2.3.5 *Static Pairwise Separations for Arrivals and Departures (AO-0306 and AO-0323)*

- Develop methodology for optimising grouping into 6 categories based on traffic mix
- Define methodology for automatic type wise definition of separation
- Refine departure time separations on the basis of new LiDAR campaigns and flight simulation

1.3.2.2.3.6 *Dynamic Pairwise Wake Separations for Arrivals for Arrival and Departure (AO-0307 and AO-0324)*

- Verify how much wake behaviour of aircraft landed in the previous 10/15 minutes is a good indicator of the wake risk generated by an approaching aircraft

- Develop methodology allowing to define wake separation as function of wake measurement of preceding aircraft.
- Develop methodology allowing to define wake separation as function of real time wake measurements.
- Identify set of conditions allowing full relaxation of wake separation
- Evaluate the impact of early rotation point on departure wake separation
- Evaluate the predictability of the rotation point and associated uncertainty that could impact wake separation design
- Evaluate the impact of early lateral displacement between leader and follower departure
- Evaluate the trajectory uncertainty in case of early the lateral displacement that could impact wake separation design

1.3.2.2.3.7 *Delegation of Dynamic Separation to the Aircraft (AUO-0504)*

- Synchronisation of the integration simulator with the traffic generator
- Coordination and maintenance of coherent ground and air vision the applied separations
- Visualisation and procedure for the pilot to anticipate on the leading aircraft speed evolution to maintain performance in separation delivery equivalent to ground support tool.

1.3.2.2.4 Validation methods, techniques and tools

1.3.2.2.4.1 *Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival and departure (AO-0334 and AO-0315)*

- The separation delivery tool (AO-0328) being V3 in Wave 1 and already using static analytical prediction, the evolution of the Separation Delivery Tool will not need dedicated RTS and will only make use of the AO-0328 and AO-0329 functionalities.
- Fast time simulations will be used for the cost benefits analysis assessments quantifying benefit as a function of prediction performance.
- Radar and wind data collection campaigns will be conducted for supporting the development of the ML/BD algorithms improving separation delivery tool performance by reducing uncertainty related to aircraft behaviour and wind evolution. Radar and wind data collection campaigns will also be used for demonstrating the reliability of the buffer computation coping with aircraft behaviour and wind profile deviation from the prediction.

1.3.2.2.4.2 *Dynamic Pairwise Runway Separations for Arrivals (based on ground information) (AO-0335)*

- The separation delivery tool (AO-0328) being V3 in Wave 1 and already using static ROT values, the dynamic definition of the expected ROT will not need dedicated RTS and will only make use of the AO-0328 and AO-0329 functionalities.
- Ground and airborne Radar data complemented by Wind data collection campaigns will be used for developing BD/ML prediction model of runway occupancy time, runway exit point, rolling distance of departing aircraft.
- Live trial(s) in shadow mode will be organised to validate new inputs combined with the BD/ML prediction model has reach acceptable reliability level.
- Live trial(s) will be complemented by fast time simulations that will be used to assess capacity impact of all the procedures.
- Fast time simulations that will be used to assess capacity impact of all the procedures.

1.3.2.2.4.3 *Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (AO-0336)*

- ROT prediction will be compared to actual ROT based on in-service analyses (back-to-back simulations using the same environmental conditions)
- Fast time will be used for quantifying the benefits of reduced ROT using to better prediction on in terms of runway throughput
- Flight test may be performed

1.3.2.2.4.4 *Enhanced Approach Procedures (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)*

- In order to achieve the target maturity, the concepts and the ATC tool prototype will be validated through Real Time Simulations. Professional ATCO controllers and pilots will be used in the experiments..
- The assessment of runway markings, approach lightings be done through Real Time Flight Simulations with professional pilots.

- Real time simulations will be complemented by fast time simulations that will be used to assess capacity and environmental impact of all the procedures.

1.3.2.2.4.5 *Static Pairwise Separations for Arrivals and Departures (AO-0306 and AO-0323)*

- Traffic and Radar data campaign will be used for defining the methodology allowing to design separation minima using more categories or different categories for more optimised use depending on the traffic mix
- Aircraft manufacturer data collection campaign be used for the inclusion of new aircraft types in pairwise matrixes
- Fast time simulations that will be used to assess capacity impact of all the procedures.
- Flight simulation that will be used for quantifying resistance of departing aircraft to wake encounter

1.3.2.2.4.6 *Dynamic Pairwise Wake Separations for Arrivals for Arrival and Departure (AO-0307 and AO-0324)*

- The separation delivery tool (AO-0328 and AO-0329) being V3 in Wave 1 and already using static wake separation, the dynamic definition will not need dedicated RTS and will only make use of the AO-0328 and AO-0329.
- Data collection campaign of real time available aircraft characteristics will be conducted for developing ML/BD model allowing to define Dynamic Wake Separation for Arrival and Departure
- Live trial in shadow mode will be organise to validate the use of real time LiDAR measurement for defining Dynamic Wake Separation.
- Fast time simulations that will be used to assess capacity impact of all the procedures
- Validation technique (e.g. Gaming, expert group) to investigate the Human Performance and Safety areas and identify any issues for the development of the dynamic wake separation

1.3.2.2.4.7 *Delegation of Dynamic Separation to the Aircraft (AUO-0504)*

- Real Time simulation will be used for evaluating the controller-pilot communication and the overall procedure
- Flight test may be performed

1.3.2.2.5 Validation platforms and V&V Infrastructure

For **EUROCONTROL** real time simulations addressing Advanced Separation Delivery, Enhanced Approach Procedures and Advanced Mix Mode the following platforms will be used:

- ESCAPE (EUROCONTROL Simulation Capability and Platform for Experimentation) a real-time simulation platform developed by EUROCONTROL supporting small to large scale simulations.
- eDEP EUROCONTROL's ATC Tower system simulator
- ITWP (Integrated Tower Working Position).

These platforms will be used simultaneously to have a realistic environment for approach and tower controllers on arrivals and departures.

For fast time simulations, EUROCONTROL will use Fast-time Runway Efficiency Assessment Platform, an in-house developed fast time modelling platform developed using Matlab Package.

LMCT and Leosphere EUROCONTROL LiDAR will also be used for wake and wind data collection campaign.

For **AIRBUS**, Airtop will be used for fast-time simulation potentially together with flight test for assessing the A/G data exchanges for ROT prediction

For **LDO**, Ground Weather Management System (GWMS) will be used to integrate and test METForWTS and wind capabilities

1.3.2.2.6 Validation scenarios

1.3.2.2.6.1 *Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival and departure: OI Name (AO-0334), OI Name (AO-0315)*

- Single runway operations in Segregated mode, capacity constrained airport

1.3.2.2.3.2 *Dynamic Pairwise Runway Separations for Arrivals (based on ground information) (AO-0335)*

- Single runway arrival operations in Segregated mode, capacity constrained airport

1.3.2.2.6.2 *Dynamic Pairwise Runway Separations for Arrivals (based on ground information) (AO-0335)*

- Single runway arrival operations in Segregated mode, capacity constrained airport

1.3.2.2.6.3 *Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (AO-0336)*

- Arrival only for segregated runway and capacity constrained airport
- 1.3.2.2.6.4 *Enhanced Approach Procedures (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)*
- EAP mixed with Instrument Landing Systems (ILS), GBAS or RNAV arrivals, single runway operations in segregated Mode, capacity constrained airport
- 1.3.2.2.6.5 *Static Pairwise Separations for Arrivals and Departures (AO-0306 and AO-0323)*
- Single runway operations in segregated mode, capacity constrained airport
- 1.3.2.2.6.6 *Optimised Runway Delivery in Mixed Mode Operations (AO-0332)*
- Runway Separation in distance and TBS for arrivals and departures, fully integrated ORD+ and OSD+ support with new functionalities, single runway operations in segregated mode, capacity constrained airport
- 1.3.2.2.6.7 *Dynamic Pairwise Wake Separations for Arrivals for Arrival and Departure (AO-0307 and AO-0324)*
- Single runway operations in Segregated mode, capacity constrained airport
- 1.3.2.2.6.8 *Delegation of Dynamic Separation to the Aircraft (AUO-0504)*
- Single runway operations in segregated mode and mix mode, capacity constrained airport
- 1.3.2.2.7 Sequence of validation activities:
- 1.3.2.2.7.1 *Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival, departure and mix-mode (AO-0334 and AO-0315)*
- FTS – Q2 2022 – **Exercise 6**
- Ground and airborne Radar data complemented by Wind data collection campaigns – Q1 2020 to Q2 2022
- METForWTS – Q3 2022 – **Exercise 13**
- 1.3.2.2.7.2 *Dynamic Pairwise Runway Separations for Arrivals (based on ground information) (AO-0335)*
- Ground and airborne Radar data complemented by Wind data collection campaigns – Q1 2020 to Q2 2022
- Live trial in shadow mode – Q1 to Q2 2021 – **Exercise 4**
- Live trial in shadow mode – Q1 to Q2 2022 – **Exercise 5**
- FTS – Q2 2022 – **Exercise 6**
- 1.3.2.2.7.3 *Dynamic Pairwise Runway Separations for Arrivals (based on A/G data exchange) (AO-0336)*
- Data collection and analysis for arrival – Q1/2 2020
- Data collection and analysis for departure – Q1/2 2020
- Back-to-back simulations based on in-service data and in-house aircraft performance models, for arrival and departure – Q3 2021 to Q1 2022 – **Exercise 8**
- Airtop FTS for arrival and departure – Q1/Q2 2021 – **Exercise 9**
- 1.3.2.2.7.4 *Enhanced Approach Procedures (AO-0308, AO-0319, AO-0320, AO-0321, AO-0331)*
- ATCO survey for concept refinement – Q1/2 2020
- Prototyping session – Q3/4 2020
- RTS – Q1 2021– **Exercise 1**
- ATCO survey for concept refinement – Q3/4 2021
- Prototyping session – Q1/2 2022
- RTS – Q3 2022– **Exercise 2**
- Flight Sim – Q4 2021– **Exercise 10**
- FTS – Q2 2022 – **Exercise 7**
- 1.3.2.2.7.5 *Static Pairwise Separations for Arrival and Departure (AO-0306 and AO-0323)*
- Traffic and Radar data collection campaigns – Q1 2020 to Q2 2022
- Flight simulation – Q1 2021– **Exercise 11**
- 1.3.2.2.7.6 *Dynamic Pairwise Wake Separations for Arrivals for Arrival and Departure (AO-0307 and AO-0324)*
- Data collection campaign of real time available aircraft characteristics– Q1 2020 to Q2 2022
- Live trial in shadow mode – Q1 to Q2 2022 – **Exercise 3**
- FTS – Q2 2022 - **Exercise 6**
- Gaming, expert group or Judgemental workshop – Q4/2020
- 1.3.2.2.7.7 *Delegation of Dynamic Separation to the Aircraft (AUO-0504)*

- Real Time simulation setup Q2/Q3 2020
- Scenarios definition – Q2/Q3 2020
- RTS : Q1 to Q3 2021 - **Exercise 12**
 - 1.3.2.2.8 Most relevant dependencies with other SESAR solutions:
- Outcomes of Wave 1 solutions 02.01, 02.02, 02.03, 02.08 will be needed for solution 14. In particular the OSED, SPR, INTEROP. Mix mode and optimised departure sequence will need coordination with solution 21, prediction of ROT will be coordinated with Solution 25 and Enhanced Approach procedures with Solution 04.
 - 1.3.2.2.9 Main assumptions:
- SESAR 2020 Wave 1 will deliver the covered OI Steps at level of maturity as defined in the SESAR master plan.
 - 1.3.2.2.10 Relevant national or international research
- SESAR 2020 Wave 1 PJ02 (PJ02-01, PJ02-02, PJ02-08)
- EC SAFECLOUDS Research Project
- EC Future Sky Safety Research Project
- NEXTGEN / FAA Wake Research Program
- ICAO Wake Turbulence Study Group
- ICAO Visual Aid Working Group
- EUROCONTROL/FAA IGWG (International GBAS Working Group).
- European Universities research on aircraft and helicopter wake
- JAXA research on helicopter wake

1.3.2.3 *Solution 17 - Improved access to secondary airports*

1.3.2.3.1 Deviation from the SPD

The WAVE 2 Candidate SESAR Solutions document doesn't define use of the safety nets for the Alternative Ground Surveillance (AGS) System that is a part of Solution # 17.

During wave 1 in the framework of PJ03b SAFE, PANSAs (B4) & THALES AIR SYS completed successfully V2 validations of the safety nets dedicated for use within AGS. RTS results have shown positive impact of their existence within the system while users underline positive impact on human – machine interaction and benefit on safety.

Therefore, it is essential to continue working on the AGS design with inclusion of the safety nets that have been covered by AO-0108. This will positively benefit the Solution #17 and the V3 validations supporting the community with comprehensive design of the AGS system.

Solution will not cover approaches with IGS of up to 4.5 degrees based on SBAS to reduce the noise impact, in a similar way to the GBAS-based IGS solution developed by solution #02-02 in Wave 1 for airliners and will not cover mixed equipage (GBAS and SBAS equipped aircraft on the same runway) with respect to low interest of ANSP and airliners.

New AUO-0410 Equivalent Visual Approach and Landing operations providing improved resilience to LVC will be covered with respect to accommodation of new features of vision systems for approach operation.

There are no planned activities related to vision systems supporting take-off operational credit and taxing in low visibility with respect to low interest of industry compare to improve approach operation.

Solution will not cover mixed equipage (GBAS and SBAS equipped aircraft on the same runway) with respect to low interest of airspace users, airliners and ANSP.

All deviations from the SPD were considered and solution will focus on aspects related to the most important development in specific segment of ATM.

1.3.2.3.2 Initial maturity level and the target maturity level for the solution

- SDM-0301 of solution 17 is targeting V3 maturity level in Wave 2 (V2 activities in Wave 1)
- AO-0108 of solution 17 is targeting V3 maturity level in Wave 2 (V2 activities in Wave 1)
- AO-0333 of solution 17 is targeting V3 maturity level in Wave (V2 activities in Wave 1)
- AUO-0410 of solution 17 is targeting V3 maturity level in Wave 2

1.3.2.3.3 List the outstanding R&D needs:

1.3.2.3.3.1 Improved Capacity and Safety of Runway Operations at Secondary Airports in Low Visibility Conditions (SDM-0301) and Airport Safety Nets for Controllers at Secondary Airports (AO-0108)

- Further evaluation of the currently available video equipment and its performance in a surveillance systems;
- Further evaluation of current available air sensors that have a ground coverage and that can be used as alternative ground surveillance;
- Further works on dedicated set of Safety Nets applicable to Alternative Ground Surveillance environment;
- Elaboration of criteria (meteo, system, performance) for reliable use of system that is based on video tracking;
- Use of alternative vehicle tracking.
- Iterative assessment of methods and techniques used for detection of infringements of defined aerodrome areas based on video tracking and existing air sensors;
- Further development of dedicated HMI and its functions;
- Continuation of activities that support standardization.

1.3.2.3.3.2 Improved Approach procedures into Secondary Airports in Low Visibility Conditions (AO-0333)

- Harmonization of ATS requirements for CAT II (LPV-100) – supported by augmented GNSS.
- Development of solution enabling LPV-100 operation provided by GNSS (SBAS) currently supporting only LPV 200 operation on less equipped airport
- Development of requirements for LPV-100 procedure design
- To demonstrate that the procedures and optimised separation criteria are harmonised and facilitate similar operations at runways with similar conditions

1.3.2.3.3.3 Equivalent Visual Approach and Landing operations providing improved resilience to LVC (AUO-0410)

- Alignment of active sensor data visualization with forward scene and pilot expectation
- Combination / fusion / consistency definition of active sensor for CVS
- Definition of Visual Advantage measurement method for active sensor (e.g. radar)
- Assessment of active sensor prototype performance in various weather condition and visibilities
- Integration of SVGS in HUD for CVS
- Development of SVGS supporting LPV or CAT I based approach operation with HDD or HMD

1.3.2.3.4 Validation methods, techniques and tools:

1.3.2.3.4.1 Improved Capacity and Safety of Runway Operations at Secondary Airports in Low Visibility Conditions (SDM-0301) and Airport Safety Nets for Controllers at Secondary Airports (AO-0108)

- RTS for initial integration of the system in the live environment followed by Live Trials / Shadow mode for Controller-in-the-loop validations of the Alternative Ground Surveillance at a Secondary Airports.

1.3.2.3.4.2 Improved Approach procedures into Secondary Airports in Low Visibility Conditions (AO-0333)

- FTS, data collection and live trials will be used for validation of approach based on SBAS (“LPV-100”)

1.3.2.3.4.3 Equivalent Visual Approach and Landing operations providing improved resilience to LVC (AUO-0410)

- Off line simulation and data collection will be used for validation of approach based on LPV based SVGS approaches
- RTS for pilot evaluation for SVGS in HUD with CVS and technology simulations tools for active sensor with CVS
- RTS, data collection and live trials will be used for validation of equivalent visual operation with Combined Vision using active sensor

1.3.2.3.5 Validation platforms and V&V Infrastructure:

DASSAULT platforms

- Technology simulation tools
- Falcon simulator real time simulation

HONEYWELL platforms

- Simulation framework & tools is planned to use for intended FTS

- Human Factors Simulator is planned to use for intended RTS
- Experimental aircraft is planned to use for its intended live trials (LPV-100 like approaches and CVS approaches supported by active sensor)

PANSA (B4) / THALES AIR SYS

- Industry Based Platform in Gdańsk - continued from Wave 1

THALES Avionics platforms

- Industry-based platform to validate the potential and performance of ILS CAT I and LPV based SVGS approaches with HDD or HMD.

THALES AIR SYS platforms

- Industry Based Platform in Portugal (exact location TBC) in order to validate air sensors performances in ground tracking configuration

AIRBUS

- A320 test aircraft, flight tests will be performed in PANSA environment

1.3.2.3.6 Validation scenarios:

- 1.3.2.3.6.1 *Improved Capacity and Safety of Runway Operations at Secondary Airports in Low Visibility Conditions (SDM-0301) and Airport Safety Nets for Controllers at Secondary Airports (AO-0108)*

- Arrivals and Departures at the Runway with use of Alternative Ground Surveillance

- 1.3.2.3.6.2 *Improved Approach procedures into Secondary Airports in Low Visibility Conditions (AO-0333)*

- Approach scenarios at different airports with various satellite geometries for LPV-100 operations

- 1.3.2.3.6.3 *Equivalent Visual Approach and Landing operations providing improved resilience to LVC (AUO-0410)*

- Approach scenarios in various weather conditions and different locations for CVS using active sensor

- Low visibility approaches in simulator for SVGS on HUD operation

- CAT-I or LPV based SVGS approaches in simulator

1.3.2.3.7 Sequence of validation activities:

- 1.3.2.3.7.1 *Improved Capacity and Safety of Runway Operations at Secondary Airports in Low Visibility Conditions (SDM-0301) and Airport Safety Nets for Controllers at Secondary Airports (AO-0108)*

- Q3/2020 – RTS Alternative Ground Surveillance using camera tracking - **Exercise 1**

- Q2/2021 – Live Trials Alternative Ground Surveillance using air sensors - **Exercise 2**

- 1.3.2.3.7.1 *Improved Approach procedures into Secondary Airports in Low Visibility Conditions (AO-0333)*

- Q1/2021 – FTS for LPV-100 approach capability - **Exercise 3**

- Q1/2022 – Live Trials for LPV-100 capability provided by GNSS (SBAS) equipment - **Exercise 4**

- 1.3.2.3.7.2 *Equivalent Visual Approach and Landing operations providing improved resilience to LVC (AUO-0410)*

- Q4/2020 – RTS for Combined Vision using active sensor - **Exercise 5**

- Q4/2020 – RTS Simulation evaluation for SVGS in HUD for CVS - **Exercise 6**

- Q4/2021 – Evaluation of CVS image using active sensor (based on simulation tool outputs) - **Exercise 7**

- Q1/2022 – Live Trials for Combined Vision using active sensor - **Exercise 8**

- Q1/2022 – FTS SVGS on LPV approaches simulations - **Exercise 9**

- Q2/Q3/2021 – Live Flight test Trials for EFVS on LPV approaches - **Exercise 10**

1.3.2.3.8 Most relevant dependencies with other SESAR solutions:

- N/A

1.3.2.3.9 Main assumptions:

- SESAR Wave 1 Solutions PJ.02-06 validated OI Steps allow PJ.02-W2-17 to continue with the V3 maturity level.

1.3.2.3.10 Relevant national or international research

- N/A

1.3.2.4 *Solution 21 - Digital evolution of integrated surface management*

1.3.2.4.1 Deviation from the SPD

- (Thematic S21-T03) The provision of accurate and available mobiles navigation information will not be considered in the scope of this solution as no OI Step is linked to this Thematic, and no work is planned by any of Sol. 21 partners addressing that Thematic.
- (Thematic S21-T05) The use of Advanced Controller Working Position increasing controllers' productivity such as those developed under SESAR Solution 97 "New HMI Interaction modes for Airport Tower", linked to AO-0212 — Equivalent Visual Operations for Tower Control in Low Visibility — will not be considered in the scope of this solution as it will be fully addressed within the framework of Solution 97.
- (Thematic S21-T06) The use of new algorithms will not be considered in the scope of this solution, as no OI Step is linked to this Thematic, and no work is planned by any of Sol. 21 partners addressing that Thematic.
- (Thematic S21-T08) The solution will not consider the potential applicability to the airport surface of the autonomous automotive technologies due to limited availability of both resources and background on this specific domain.

1.3.2.4.2 Initial maturity level and the target maturity level for the solution:

PJ.02-21 will take as an input results from the SESAR wave 1 solutions PJ03a-01 Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing and PJ03b-01 Enhanced Airport Safety Nets for Controllers. The OI Steps identified inside the two solutions will achieve V2 maturity in R9. With this in mind, and knowing that Solution OI Steps are the natural evolution of those already validated in Wave 1, enabling this Solution to start the Wave 2 work directly with the V3 maturity cycle.

- All OI Steps of solution 21 are starting V2 maturity level
- All OI Steps of solution 21 are targeting V3 maturity level in R11-R12

1.3.2.4.3 List the outstanding R&D needs:

1.3.2.4.3.1 *Advanced Automated Assistance to Controller and Aircraft for Surface Movement Planning, Guidance and Routing with Data Link (AO-0224, AUO-0603-B and AUO-0308-B)*

- Further development and generalization of Routing and Guidance services.
- The combined use of automated planning support and automated guidance to relieve the ground controllers of some of their workload, while at the same time improving situational awareness.

1.3.2.4.3.2 *Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing (AO-0206) and Airport ATC provision of ground-related clearances and information to vehicle drivers via datalink (AO-0215)*

- Development of a Routing service providing continuous, de-conflicting, routing and scheduling for aircraft and ground vehicles.
- The Guidance service gives on-line guidance for vehicles thanks to datalink and an onboard monitor displaying traffic information and controllers instructions.

1.3.2.4.3.3 *Enhanced Safety in LVP through use of Dynamic Virtual Block Control (AO-0223-B)*

- Design, development and Validation of a Fully dynamic virtual block control system integrated with data link service

1.3.2.4.3.4 *Extended Safety Nets for Controllers at A-SMGCS Airports (AO-0104-B)*

- Optimize the use of CATC and CMAC Safety Net alerting functions based on the results of PJ03b-01/Wave 1. This includes the identification of new Safety Support Tools to fill identified gaps, improve the detection algorithms, evaluate the detection parameter calibration and validate the improvements under operational conditions on runways, taxiways and aprons

1.3.2.4.3.5 *Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways) (AO-0222-B)*

- Development of a Airfield Ground Lighting system through which mobiles will be guided along their cleared route taking into account tactical decisions (made by the Apron Manager, Tower Ground Controller and Tower Runway Controller) and known constraints from the surface management system.
- Development of advanced capability of the Airfield Ground Lighting to automatically switch the taxiway centerline lights and stop bars for each mobile individually according to the assigned trajectory.
- Development of algorithms and tools capable of automatically support a safe longitudinal and lateral spacing between mobiles and also managing priorities between mobiles on the aerodrome surface in all weather conditions.

1.3.2.4.4 Validation methods, techniques and tools:

1.3.2.4.4.1 *Advanced Automated Assistance to Controller and Aircraft for Surface Movement Planning, Guidance and Routing with Data Link (AO-0224, AUO-0603-B and AUO-0308-B)*

- In order to achieve the target maturity, the concepts and the ATC tool prototypes will be validated through Real Time Simulations. Professional ATCO and pilots will be involved in the experiments.

1.3.2.4.4.2 *Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing (AO-0206) and Airport ATC provision of ground-related clearances and information to vehicle drivers via datalink (AO-0215)*

- In order to achieve the target maturity, the concepts and the ATC tool prototypes will be validated through Real Time Simulations. Professional ATCO will be involved in the experiments.

1.3.2.4.4.3 *Enhanced Safety in LVP through use of Dynamic Virtual Block Control (AO-0223-B)*

- In order to achieve the target maturity, the concept and the ATC tool prototype will be validated through Real Time Simulations. Professional ATCO will be involved in the experiments.

1.3.2.4.4.4 *Extended Safety Nets for Controllers at A-SMGCS Airports (AO-0104-B)*

- In order to achieve the target maturity, the concept and the ATC tool prototype will be validated through Real Time Simulations. Professional ATCO will be involved in the experiments.
- The Real-time simulations will be complemented and supported by Shadow mode live trials simulations.
- Shadow mode live trials will evaluate the benefit of Safety Support Tools (CATC and CMAC) in real world situations at a large airport with complex layout and medium to high traffic. The trials will be performed with professional ATCOs from the airport's ATC tower. The exercise will also evaluate potential training methods and assess the impact of CATC alerting on the human actor.

1.3.2.4.4.5 *Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways) (AO-0222-B)*

- In order to achieve the target maturity, the concept and the ATC tool prototype will be validated through Real Time Simulations. Professional ATCO and pilots will be involved in the experiments.

1.3.2.4.5 Validation platforms and V&V Infrastructure:

- For **ENAV** real time simulations addressing Fully Dynamic Virtual Block Control, the Tower Simulator platform “TBA3D” at National Testing Facility in Rome Ciampino will be used. The tower platform simulator environment will be suitably equipped and adapted for the purpose of the validation exercise. That platform is nearly a duplication of the operational system currently in use, a part of the concept under evaluation, thus ensuring a high level confidence in the achieved results;
- **DFS** will setup its validation platform at Düsseldorf Tower to perform the shadow mode live trials. The validation platform includes the DFS Surface Manager (SMAN) which hosts the Safety Support Tools prototype;
- **ENAIRE / INDRA TWR IBP** is nearly a duplication of the operational system with enhanced routing and alerting functions (extension and improvement of CATC and CMAC) to support tactical conflict management in the apron and during the taxi phase. Moreover the integration with sequencing tools (AMAN/DMAN) inputs will provide more accurate predictions during the planning phase. Solution will increase automation for ATC in tower ground positions, reducing their workload and increasing their situational awareness.
- **HUNGAROCNTR** / **Indra Navia IBP** using Budapest Airport as demonstration site to validate the use of AGL for providing guidance to aircraft and vehicle drivers in different visibility conditions. Solution will share ATC clearances for vehicles in order to increase their situational awareness using a moving map. The exercise will focus on tailoring routing information and the safety nets function to provide timely information.
- **LDO** Ground Platform with enhanced routing functions, data link and stripless environment to support aircraft and vehicles management on the airport surface, Extension and improvement of CATC and CMAC alerting functions to apron and parking stands areas
- **THALES AIR SYS** platform. Industry Based Platform in Portugal (exact location TBC) including extended routing and guidance functions, as well as CATC and CMAC improvements, in order to validate surface management in continuation of wave1.

1.3.2.4.6 Validation scenarios

1.3.2.4.6.1 *Advanced Automated Assistance to Controller and Aircraft for Surface Movement Planning, Guidance and Routing with Data Link (AO-0224, AUO-0603-B and AUO-0308-B)*

- Combined use of automated planning support and automated guidance at a complex airport layout, in high traffic and low visibility condition
- Both nominal and non-nominal condition

1.3.2.4.6.2 Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing (AO-0206) and Airport ATC provision of ground-related clearances and information to vehicle drivers via datalink (AO-0215)

- Assessment of the use of data link service to exchange messages between controllers and vehicle drivers at Sofia Airport operational environment
- Assessment of airport moving map with clearance information for vehicle drivers at Budapest airport

1.3.2.4.6.3 Enhanced Safety in LVP through use of Dynamic Virtual Block Control (AO-0223-B)

- Taxi-in and Taxi out surface traffic operating at Milan/Malpensa airport environment
- Nominal and non-nominal condition

1.3.2.4.6.4 Extended Safety Nets for Controllers at A-SMGCS Airports (AO-0104-B)

- Complex airport layout, high traffic in shadow mode
- Complex airport layout, high traffic and low visibility condition scenarios
- Nominal and non-nominal condition

1.3.2.4.6.5 Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways) (AO-0222-B)

- Complex airport layout, high traffic and low visibility condition scenarios
- Nominal and non-nominal condition

1.3.2.4.7 Sequence of validation activities

In Solution 21, unlike the other solutions, the exercises are covering several OIs and OIs are covered by several Exercises. The overlaps and complementarity being not always easy to understand in the following descriptions, an overview is provided into this table:

		AO-0104-B	AO-0206	AO-0224	AO-0215	AO-0222-B	AO-0223-B	AUO-0308-B	AUO-0603-B
Ex 1	LT	Yes							
Ex 2	RTS						Yes		
Ex 3	RTS	Yes		Yes					
Ex 4	RTS	Yes	Yes		Yes				
Ex 5	LT		Yes					Yes	Yes
Ex 6	RTS	Yes		Yes		Yes			

1.3.2.4.7.1 Advanced Automated Assistance to Controller and Aircraft for Surface Movement Planning, Guidance and Routing with Data Link (AO-0224, AUO-0603-B and AUO-0308-B)

- ATCO survey for concept refinement – Q1/2 2020
- Prototyping session – Q3 2020
- ATCO survey for concept refinement – Q1 2021
- RTS, ENAIRE, joint validation of AO-0224 – Q3/2021 – **Exercise 3**
- Prototyping session – Q2 2021

1.3.2.4.7.2 Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing (AO-0206) and Airport ATC provision of ground-related clearances and information to vehicle drivers via datalink (AO-0215)

- ATCO survey for concept refinement – Q1/2 2020
- Prototyping session – Q3 2020
- ATCO survey for concept refinement – Q1 2021
- Prototyping session – Q2 2021
- RTS, LDO, joint validation of AO-0206 – Q1 2021 – **Exercise 4**
- Live trial in shadow mode, HUNGAROCNTR and Indra Navia, joint validation of AO-0206, - Q4-2021 – **Exercise 5**

1.3.2.4.7.3 Enhanced Safety in LVP through use of Dynamic Virtual Block Control (AO-0223-B)

- Prototyping session – Q2 2021
- RTS, ENAV – Q4 2021 – **Exercise 2**

1.3.2.4.7.4 *Extended Safety Nets for Controllers at A-SMGCS Airports (AO-0104-B)*

- ATCO survey for concept refinement – Q1/2 2020
- Prototyping session – Q3 2020
- Live trial in shadow mode, DFS – Q3/Q4 2021 – **Exercise 1**
- RTS, ENAIRE, joint validation of AO-0104-B – Q3/2021- **Exercise 3**
- RTS, LDO, joint validation of AO-0104-B – Q1/2021- **Exercise 4**
- RTS, THALES AIR SYS, joint validation of AO-0104-B – Q3 2021 – **Exercise 6**

1.3.2.4.7.5 *Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways) (AO-0222-B)*

- ATCO survey for concept refinement – Q1/2 2020
- Prototyping session – Q3 2020
- RTS, THALES AIR SYS, joint validation of AO-0222-B and AO-0224 – Q3 2021 – **Exercise 6**
- Live trial in shadow mode, HUNGAROCONTROL and IndraNavia, joint validation of AO-0222-B, - Q4-2021 – **Exercise 5**

1.3.2.4.8 Most relevant dependencies with other SESAR solutions:

- The Solution integrates the input from airport DCB processes (that takes into consideration information provided by airport sequencing tools e.g. AMAN / DMAN) in order to determine potential conflicting situations when planning taxi routes. However, it is assumed those input are available, e.g. generated specifically to fit with the solution validation exercise needs, and so the dependency is only limited to the conceptual implementation and not a project constraint.
- PJ02.14. Solution 14 - separation minima for approach and departure in an increased runway throughput environment – should provide input to this Solution in order to set-up the right separation minima for the calibration of Safety Nets
- PJ05.97. There should not be any dependency with Solution 97 “New HMI Interaction modes for Airport Tower” as that solution shall address AO-0212—Equivalent Visual Operations for Tower Control in Low Visibility – and to do so could take as input the DataPack already produced by PJ03a-01 in the previous wave 1.

1.3.2.4.9 Main assumptions:

- SESAR Wave 1 Solutions PJ03a-01 and PJ03b-01 validated OI Steps allow PJ02.21 to start directly with the V3 maturity cycle.

1.3.2.4.10 Relevant national or international research

- SESAR Wave 1 PJ03a-01 Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing
- SESAR Wave 1 PJ03b-01 Enhanced Airport Safety Nets for Controllers

1.3.2.5 *Solution 25 - Safety support tools for avoiding runway excursions*

1.3.2.5.1 Deviation from the SPD

- N/A

1.3.2.5.2 Initial maturity level and the target maturity level for the solution:

- All OI Steps of solution 25 are starting at V2 maturity level from Wave 1 development activities.
- All OI Steps of solution 25 are targeting V3 maturity level in R12

1.3.2.5.3 List the outstanding R&D needs:

1.3.2.5.3.1 *Improved Awareness of Runway Friction Evolution (AUO-0606)*

- Validation performed in Wave 1 around on-board runway braking action assessment was not successful to reach complete V2 maturity due to limitation in the validation method and tests schedule. Wave 2 works will concern a complete loop with ground RCAMS continuous assessment of runway surface condition and on-board runway friction assessment at landing
- On-board runway surface contamination assessment using computer vision means shall bring improvements to RCAMS in Wave 2
- To improve safety especially on regional and local aerodromes (less sophisticated runway surface monitoring, lower maintenance capabilities and lower friction survey frequency) by mitigating runway

excursion risks, above on-board runway surface assessment means could be used to improve airspace users knowledge on runway surface contamination

1.3.2.5.3.2 *Improved Safety with Better Prevention of Runway Excursions for Pilots (AUO-0616)*

- Take-off monitoring system to integrate runway surface condition to help flight crew during flight preparation and take-off performance assessment and take-off
- Computer vision development will also benefit to pilots during take-off and landing operations
- ROAAS alerting system, validated in Wave 1, will be coupled to OBACS to take into account current runway friction as assessed during landing roll

1.3.2.5.3.3 *Enhanced Runway Condition Awareness for airport operator (AO-0216)*

- RCAMS, validated at V2 maturity level in Wave 1, will progress towards V3. Integration with on-board will be finalized and tested in real time/operation condition. Other sensors (Mobile ground sensors, computer vision, more detailed weather observation) will be added to assess more efficiently percentage of runway coverage.
- RCAMS shadow mode use is expected to consolidate all airport stakeholders working methods.
- Continue wave 1 development of augmented machine learning approach to handle rare and/or extreme weather conditions better.

1.3.2.5.3.4 *Enhanced Runway Condition Awareness for controllers (AO-0107)*

Provision of the RWYCC awareness for controllers shall lead to development of the use case, when Solution 14 may benefit from an alert (safety net) bringing attentions to a flight which can no more satisfy ROT constraints will be extended when estimated landing roll exceeds last runway exit or runway length, especially when flight is cleared to a displaced threshold.

1.3.2.5.4 Validation methods, techniques and tools:

- Workshops involving Airport Operator, Air Navigation Service Providers and Aircraft Manufacturer (AIRBUS-NAVBLUE) will be organized to define operational interoperability and performance requirements between OBACS (including results positioning on runway and full RCAMS Braking Action levels coverage which was not available for Wave 1) and RCAMS.
- In order to have the required flexibility to verify these operational interoperability and performance requirements, a set of simulations will use real recorded OBACS and RCAMS input data in a preparatory (platform development) phase.
- Shadow Mode validation, using real time OBACS and RCAMS input data, will complete the simulations in order to have performance and operational representativeness at the expected V3 maturity level.
- On-board runway braking action assessment: complete loop with ground RCAMS assessment, computer vision; FTS, RTS for integration purpose; shadow mode to complete V3 validation.
- Coordination with Solution #14 (ROT shadow mode using RWYCC) to validate AO-0107 use case.
- V3 validation on the RCAMS current and predicted Runway Condition Code assessment; V2 activities in Wave 1 (FTS) will be completed by coverage estimation with use of mobile sensors and real time integration with avionics manufacturers for data exchanges (simulations followed by shadow mode operations).
- Fast Time Simulation will be used to assess coupling between ROAAS and OBACS to consider assessed runway friction during landing roll.
- For Take-off monitoring system to integrate runway surface condition (existing tool used for flight preparation, take-off performance assessment and take-off), Airspace Users workshops will develop concept and requirements for system input. When needed, mock-up will support test pilots validation.
- Fast Time Simulation will be used to assess computer vision benefits in contaminant or incorrect trajectory detection.

1.3.2.5.5 Validation platforms and V&V Infrastructure:

- For **AIRBUS**, in the continuation of Wave 1, new version of OBACS will be deployed on airline fleets to collect real time braking assessment on landing and prototype flight trials to validate computer vision
- For **DASSAULT**, Prototype flight trials for OBACS and Fast Time Simulation for coupling between ROAAS and OBACS
- For **PANSA (B4) and its LTPs**, Wave 1 Gdansk (PL) & Poprad (SK) platforms will be used for shadow mode operations & testing (simulations to be used in preparatory phases)

AIRBUS, DASSAULT and PANSA (B4) platforms will be used simultaneously to have a realistic shadow mode environment for all stakeholders working method validation.

1.3.2.5.6 Validation scenarios:

- RCAMS runway condition assessment using complete set or selected inputs (OBACS report on braking action, airborne computer vision report on runway contaminant, embedded runway sensors, mobile runway sensors, weather observations and forecasts, etc.). FTS will complete Wave 1 works with new inputs in a preparatory phase; RTS and shadow mode will allow new working method to be compared with ICAO GRF operations and validated.

1.3.2.5.7 Sequence of validation activities:

1.3.2.5.7.1 Workshops (AO-0107, AO-0216, AUO-0606, AUO-0616)

- Workshops with stakeholders on concept refinement.

1.3.2.5.7.2 RCAMS/OBACS/ROAAS integrated shadow mode exercise (AO-0216, AUO-0606, AUO-0616)

- Data collection, FTS and RTS preparatory phase: from Q1/2020 – to end of Q3/2020.
- Shadow mode validation involving all stakeholders to validate working methods around RCAMS, OBACS: from Q4/2020 to Q4/2021 – **Exercise 1**
 - DASSAULT Prototype flight trials to validate OBACS and solution complete loop from runway surface condition assessment to flight crew use: from Q4 2020 to Q2 2021 in Gdansk and/or Poprad.
 - RCAMS in Gdansk and Poprad airports fed by real time inputs (local sensors of the airport, weather forecast, OBACS computed braking action report after landing), delivering continuous runway surface condition assessment: from Q4/2020 to Q4/2021.

1.3.2.5.7.3 Take-off monitoring system integrating runway surface condition (AUO-0616)

- Take-off monitoring system validation on mock-up: from Q4/2020 to Q4/2021 – **Exercise 2**

1.3.2.5.7.4 Controller alert in case of runway excursion risk (AO-0107)

- Solution 14 joint exercise to validate AO-0107 (ATCO) use case: “Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival, departure and mix-mode”, in which computed ROT of the flight exceeds the maximum time planned or landing roll of the flight exceeds the runway length
 - ATCO survey for concept refinement – Q1/2 2020
 - Use case validation session(s) – Q1/2/3 2021

1.3.2.5.8 Most relevant dependencies with other SESAR solutions:

- Solution 14 Exercise 1 (PJ.02-14) Q3/2022 – **Exercise 3**
 - Optimised Separation Delivery for Arrivals (with complex separation rules) for arrival, departure and mix-mode exercise may benefit from developments of RCAMS/OBACS/ROAAS integrated exercise to support take-off and landing performance assessment.
 - Provision of an alert in situation, where computed ROT of the flight may exceed the maximum time planned or landing roll of the flight exceeds the runway length, shall improve situational awareness and safety. Synergy between solutions (use case) will be discussed at a dedicated, joint workshop, and might be followed by use of V3 developments in an exercise.

1.3.2.5.9 Main assumptions:

SESAR 2020 Wave 1 will deliver the following OI Steps at the following levels of maturity:

- AO-0107 at V2 maturity
- AO-0216 at V2 maturity
- AUO-0606 at V2 maturity
- AUO-0616 at V2 maturity

1.3.2.5.10 Relevant national or international research

- N/A

1.4 Ambition

1.4.1 *Solution 4 - Advanced geometric GNSS based procedures in the TMA*

Describe the advance your proposal would provide beyond the state-of-the-art:

The high level objective of Solution 4 – Advanced geometric GNSS based procedures in the TMA is to lower environmental impact of TMA operation, due to flight path shortening and more predictable operations, which will have a direct impact on noise levels. In today's operation, a significant amount of the fuel inefficiencies are related to the TMA operation, and especially during the arrival phase. By making the TMA operation more predictable, significant improvements are expected in terms of efficiency, which will have a direct influence on e.g. gaseous emissions. To achieve this goal, a paradigm shift is required in how we manage traffic in high density TMA, compared to today's operation.

Describe the innovation potential:

Today's high density TMA operation is typically based on tactical intervention, and seen as unpredictable (from an airborne perspective), having impact on fuel consumption, flight time etc. This is especially true for arriving aircraft; a high granularity is seldom observed/achieved in the approach phase with respect to time, which will have a direct influence on the "turn-around process", involving many different stakeholders. By improving the time accuracy, all different stakeholders will draw benefit of this increased quality in precision. Throughout the SESAR 1 programme, various initiatives showed the potential by using PBN, and combined with CDO, large improvements in efficiency were observed (e.g. the VINGA project). This was typically done in low density TMA operation. By implementing advanced curved flight procedures in high density TMA, multiple objectives can be achieved:

- Flight path shorting is achievable.
- Better control of aircraft noise.
- Improved environmental efficiency (A-CCO & A-CDO).

Describe the added value of the project and/or solution:

One of the key areas linked to enabling sustainable growth is to improve flight efficiency in high density TMA. Data from EUROCONTROL PRU particularly highlights this matter for the arrival phase in today's operation. To improve vertical and lateral flight efficiency in the TMA, focus needs to be on CDO and short curved procedures. By having curved procedures, additional benefits can be drawn by ensuring repeatability in trajectories flown.

1.4.2 Solution 14 - Evolution of separation minima for increased runway throughput

Describe the advance your proposal would provide beyond the state-of-the-art:

Static reduction of wake separation have been already achieved with RECAT-EU. The solution will go beyond these reductions by using all available sources of dynamic/tactical information for defining wake separation minima that are strictly needed at a given time with a high potential of further runway throughput increase.

The ATCO support tool will be further developed beyond the existing separation delivery functions performance. This will include better definition of safety buffer for coping with aircraft behaviour and wind evolution uncertainty.

Enhanced approach procedures will allow further reduction beyond static wake separation and reduction of noise footprint.

Delegation of separation to pilot would result in capacity benefits and potentially flight efficiency and safety benefits (by reducing the number of spurious Go Around).

Describe the innovation potential:

The solution will go one-step further in the integration of concept for optimising local operation by developing standard mechanisms of separation delivery and will progressively delegate this to the flight deck.

Describe the added value of the project and/or solution:

The solution will develop on-line services for ANSP to identify easily the potential of each solution as a function of their local operations. Guidance material will also be developed on-line to facilitate local industrialisation. A certain number of safety critical calibration of the ATCO support tool will be facilitated by development of ML/BD algorithm. The link between these algorithm and safety target will be ensured and demonstrated once for all to avoid duplication and waste of time and effort during deployment.

1.4.3 Solution 17 - Improved access to secondary airports

Describe the advance your proposal would provide beyond the state-of-the-art:

The solution uses an unconventional approach to address challenges coming from network growth and capacity issues. It develops series of innovations, that target and supports controllers (ATS) and pilots. Its unique approach is to develop technologies, well supported with procedures, that will individually bring significant

improvements, especially to safety, predictability and resilience allowing to unlock the hidden capacity of secondary airports, allowing them better integration with the network.

Overall ATM performance will also be increased by the ultimate goal of the proposed innovations and by keeping the final cost of the solution at a reasonable level. Wide use of GNSS based systems, vision systems with improved performances and cost-efficient surveillance will provide comprehensive set of tools dedicated to usually less developed community of secondary airports and their users.

Implementation of adopted project results shall also bring the benefit to different environment (e.g. primary airports), allowing applicability of the advancements in full ATM context.

Describe the innovation potential:

Unique approach is to combine different surveillance equipment, software and procedures that will bring state-of-the-art technology to a wide applicability on ATM. While the Solution's objectives are to support the secondary airports, a benefit may be ultimately available for all other ATM environments: Alternative Ground Surveillance development might be adjusted and used instead of SMR to support the surveillance systems at primary, congested airports or will build further value in the remote tower environment. The vision system concepts and enhancing GNSS performances will also find applicability on mainline aircraft, at well-equipped airports and future concepts like single pilot operation.

Unique approach is to maximize benefit from adaptation of the existing developments and COTS products, allowing flexibility of components and reduction of retrofit or upgrade costs.

Describe the added value of the project and/or solution:

The concept has potential to be extended to non-ATC environments through an affordable ATS service (AFIS) in the context of Low Visibility Conditions thus extending the operational readiness of small / regional airports. It will also bring improvements targeting reuse of currently existing equipment for new purposes (e.g. cameras as sensors).

The innovation potential is also linked with reducing costs of vision systems and increasing situation awareness by using head-mounted displays and improved resilience to low visibility conditions using combined vision with advanced active sensor. SVGS and SBAS-based ("LPV100") RNP APCH procedures enable better accessibility by lowering decision height

1.4.4 Solution 21 - Digital evolution of integrated surface management

Describe the advance your proposal would provide beyond the state-of-the-art:

The solution will validate to V3, Advanced Guidance and Routing functions providing conflict free taxi routes and improved taxi times leading to increased predictability of surface operations and better optimisation of airport surface traffic flows. Conflicts and potential deadlocks are also avoided by route adjustments communicated by means of Data link, Follow-the-Green, AGL, VSB, which may be combined and that will be used in some of the validation exercises. All of this aims to reduce any potential misunderstanding that can occur when voice communication is used and, therefore, alleviate both pilots and controllers workload.

In addition, a more efficient integration of information coming from different functionalities (such as routing, planning and guidance) is expected to positively impact controllers, pilots and vehicle drivers situational awareness and, therefore, maintain or increase the current level of safety with increasing traffic. A contribution to Safety is also expected from the implementation of CATC and CMAC alerting functions for Controllers on runways, taxiways and in the apron/stand/gate area as well as unauthorized / unidentified traffic thanks to detection of potential and actual conflicting situations, incursions and non-conformance to procedures or ATC clearances. Appropriate predictive indications and alerts are provided to Controllers for any concerned mobiles and stationary traffic.

Describe the innovation potential:

In SESAR wave 1 the above concepts/tools and supporting OI Steps/Enablers have been validated achieving a V2 Maturity. The outcome of the V2 maturity assessment, as well as main outcome from the validation activities, will be duly taken into account. On the other hand, PJ02-21 shall aim at addressing V3 as target maturity level to be reached at the end of Wave 2. The evaluation of concept will be carried out on pre-industrial prototyped platform with real surveillance data and, for some OI Steps, complemented with shadowed clearances.

Describe the added value of the project and/or solution:

The development of advanced routing and guidance, integrated with A-SMGCS, will significantly improve the prediction of variable taxi times from planning to execution phase. This has potential to support improved

smooth traffic flows as well as improved planning of operations through the better prediction of taxi times accuracy in any weather condition.

1.4.5 Solution 25 - Safety support tools for avoiding runway excursions

Describe the advance your proposal would provide beyond the state-of-the-art:

From 5th November 2020 on, ICAO requires the implementation of the Global Reporting Format (GRF) for assessing and reporting runway surface conditions in a standardized manner: based on the Take-off And Landing Performance Assessment (TALPA) matrix which gives a Runway Condition Code (RWYCC) for each third of each runway, depending on the contaminant type and depth and on flight crews Air Reports (AIREP) subjectively assessing their aircraft braking action.

The Solution focuses on maximization of advanced information that improves awareness of ground and flight crews, so that more accurate and up to date information about the runway condition exists allowing increased safety of departures and arrivals.

Describe the innovation potential:

The solution will continue advancing the PJ03b-06 work adding further ground sensors and weather information inputs, including use of braking action data from airborne source (OBACS data), to provide a continuous and objective assessment of the runway surface condition, limiting the need of runway inspections. Use of new, on-board computer vision may provide new inputs to the solution for contaminant surface coverage and contaminant identification. Use of mobile sensors is also considered for assessment purpose.

Runway Overrun Awareness and Alerting System (ROAAS) is intended to reduce risk of overrun during landing by providing alert to the flight crew when the airplane is at risk of not being able to stop on the available distance of the runway. In addition to MOPS ED-250 ROAAS standard specification, friction observed at landing by the aircraft may be looped back in the system to continuously adjust landing performance assessment and alerts and advisories generated by the system to the flight crew.

Describe the added value of the project and/or solution:

The benefit of this Solution is expected primarily in Safety, but also in Resilience to adverse weather conditions, through an improved management of runway condition information leading less to flight diversions and better resource management. This benefit shall be achievable at all kinds of airports (primary and secondary) and may lead to increased runway throughput by reduced sensitivity to weather conditions-incurred events.

2 Impact

2.1 Expected impacts

i. Technical Impact

- By researching new highly sophisticated technologies and Concept of Operations in the TMA, Solution 4 will have a positive technical impact in the future, enabling higher runway throughput and more stable operations in terms of predictability.
- Solution 14 will both reduce the observed separation during approach and departure by better design of the target minima and by improving the separation delivery
- Solution 17 will have a positive technical impact linked with innovation methods and technologies used for ground surveillance and transport navigation
- Solution 21 will improve the efficiency of airport operations and the situational awareness of concerned airport stakeholders in all operational and weather conditions
- Solution 25 will improve the situational awareness of the main airport stakeholders about the runway condition in order to take the appropriate actions at the right time

ii. Economic Impact

- Solution 4 will primarily have a positive economic impact linked to AU operations, due to shorter and more efficient flight paths, but also by having positive impact on airport operations in terms of runway throughput and better predictability in the operations.
- Solution 14 will build on experience gained in improving performance from previous concepts in the domain to continue to improved economical efficiency of European airport

- Solution 17 will have an economic benefit with significant reducing costs for runway and airborne equipment required for operation in LVC and therefore reducing costs linked with delayed, diversion and cancelled flights
- Solution 21 will benefit to reduction of taxi-time, optimum use of airport resources and airport resilience and is contributing to keep the overall network capacity, reducing flight delays and cancellation in case of low visibility conditions and will improve the efficiency of airports operations providing timely information to the ATCO, pilot and vehicle drivers
- Solution 25 will benefit to airport resilience during adverse weather situation event. Real time knowledge on current and predicted runway condition will allow airport stakeholders to take the appropriate actions at the right time.

iii. Social Impact

- Solution 4 will have social impact in terms of lowered noise, as well as distributing noise in a much more dynamic manner compared to today's operation.
- Solution 14 will significantly contribute to reduce noise impact on population around the airport without compromising safety and performance
- Solution 17 will have a social impact linked with availability of the secondary airports and therefore growing population and businesses in these locations
- Solution 21 will improve the overall performance and continuity of services for passengers, citizens, airlines and any other concerned stakeholders who will benefit from the reduction of taxi-time and optimum use of airport resources
- Solution 25 benefit to airport resilience thus support service continuity to every airport stakeholder, including passengers, airlines, and, in particular, a better anticipation and safer management of public transportation.

	Defrag. of service provision	Interoperability	Sharing of infrastructure	Scalability	Increasing network capacity	Access to airports	Deployment oriented	Innovation capacity
PJ.02-04		H	M	H	H	H	M	H
PJ.02-14			M	H	H		H	H
PJ.02-17			M		H	H	H	
PJ.02-21					M	M		L
PJ.02-25						M	H	L

Table : KPA for solution as set out in the SPD

2.1.1 Solution 4 - Advanced geometric GNSS based procedures in the TMA

2.1.1.1 Contribution of the solution to expected impacts on KPAs

Interoperability (H): : Solution 4 will enable seamless exchange of information between systems, which is a prerequisite for this Concept to work, especially in a mixed mode environment.

Sharing of infrastructure (M): Solution 4 is based on information sharing and sharing of CNS, which is a prerequisite to meet the objectives, i.e. enabling advanced curved efficient operation in the TMA.

Scalability (H): Solution 4 aims to enable curved operations in a high density TMA. This concept will also meet the requirements of lower density TMA operation as well.

Increasing network capacity (H): By allowing aircraft flying shorter trajectories and having better granularity in the intended trajectory in the TMA, this will have positive impact on network capacity, due to increased runway throughput.

Access to airports (H): This solution is foreseen to increase access to airports. This is related to the use of advanced curved routes (arrivals and departures) potentially allowing airport access during both day and night, which is a true enabler to meet future environmental challenges. It will also give the possibility to access the airport in an efficient and predictable manner.

Deployment oriented (M): There is a clear and identified need for R&I in this domain, whilst we need to recognize that the intended activities intend to meet V2 maturity level for the arrival phase, and the target is V3 for aspect of the intended work in the departure phase.

Innovation capacity (H): Solution 4 aims to merge many complex tasks in different domains, relevant for all stakeholders, including seamless information sharing, between air-ground and ground-ground.

2.1.1.2 *Barriers/obstacles:*

Currently, there is no ICAO standardisation on the mixed usage of geometric GNSS and Barometric altitude in the TMA. The same applies to advanced usage of curved operation close to the departure runway. It is unclear at this stage what the public reaction will be on future novel operational concepts.

2.1.1.3 *Standardisation activities*

The work intended to be conducted in Solution 4 could act as input to:

- ICAO PBN Manual (Doc 9613)
- RNP AR Authorization Required (AR) Procedure Design Manual (Doc 9905)
- ICAO PANS-OPS Volume 1 & 2 (Doc 8168)
- ICAO PANS-ATM (Doc 4444),
- ICAO SOIR (Doc 9643).

2.1.2 **Solution 14 - Evolution of separation minima for increased runway throughput**

2.1.2.1 *Contribution of the solution to expected impacts on KPAs (this is different from Wave 1 see guidances provided)*

Sharing of infrastructure (M): Services developed by the solution for calibration of local separation delivery tool will allow to share safe common approach and avoid duplication of effort for each local deployment.

Scalability (H): Additional runway throughput will allow Very Large, Large and Medium airports to better accommodate seasonal demand when this exceeds the currently available runway throughput.

Increasing network capacity (H): The increase in runway throughput will have a significant impact on the overall network that was already assessed in Wave 1 and that will be further quantified in Wave 2.

Deployment oriented (H): All OI Steps will be developed reusing methodology that supported the deployment of Wave 1 OI Steps like RECAT and TBS. The safety cases will be developed for meeting SJU requirements but also for being direct inputs to EASA regulatory processes. Guidance and on line services will be developed for facilitating the access to the information and eventually local deployments.

Innovation capacity (H): The move towards a more integrated and efficient runway management initiated with TBS will be continued opening new market opportunities for industry towards modernisation of runway management tool and processes.

2.1.2.2 *Barriers/obstacles:*

- Big data and machine learning algorithm performance have to be confirmed to allow prediction of all the dynamic aspect of separation design and delivery
- Flight simulators used in Wave 1 may not be available anymore, that could be an obstacle to reproduce the assessment of Static PWS-D with the methodology used for Static PWS-A.
- Quality and usability of available LiDAR wake measurement data for departure is not totally confirmed yet for refinement of Static PWS-D.

2.1.2.3 *Standardisation activities*

- Safety cases will be prepared for being direct inputs to regulatory process
- Specification and guidance documentation will be direct input for ANSP willing to industrialise products developed.
- Impact assessment tool will be made available for ANSP to scope the relevant OI Steps deployment for their environment.

2.1.3 **Solution 17 - Improved access to secondary airports**

2.1.3.1 *Contribution of the solution to expected impacts on KPAs*

Sharing of infrastructure (M): Alternative Ground Surveillance may support airport blind spots as a surveillance sensor and as a video signal source for Tower Controllers. Existing RTWR cameras might also be used as sensors for AGS. The Low Cost Vehicle tracking might be used both in surveillance systems and as a simple vehicle monitoring at the airport. Existing RTWR cameras might also be used as sensors for AGS. The Low Cost Vehicle tracking might be used both in surveillance systems and as a simple vehicle monitoring at the airport. Already existing ATC infrastructure that is provided ATC services will be used for ground tracking in order to provide a minimum ground tracking service.

Increasing network capacity (H): Improved resilience in adverse weather conditions will increase network capacity through better predictability and wider availability of Secondary Airports.

Access to airports (H): Equivalent visual approach operation and improved approach procedures enabled by new on-board technologies provide improved resilience to low cloud ceilings below Decision Altitude and low RVR, relatively to RVR necessary to perform the approach. It will increase resilience to adverse weather condition on less equipped airports. Use of the equipment and procedures allowing extended use of the secondary airports below ILS CAT1 minima will improve their accessibility and will improve connectivity

Deployment oriented (H): The implementation of concepts and validation is focused on bringing maturity that allow quick deployment process of proposed solutions.

2.1.3.2 *Barriers/obstacles:*

- Limitation of existing SVGS operations on ILS SA CAT I approaches is a showstopper to widespread dissemination of SVGS capability
- Method to measure Visual Advantage provided by EVS is not defined for active/radar sensor by FAA/EASA
- To use active/radar sensor for consistency instead of EVS image is not explicitly allowed by regulation for EFVS operation
- Requirements for CAT II (LPV-100) approach operation supported by augmented GNSS are not explicitly defined

2.1.3.3 *Standardisation activities*

- Solution will support EUROCAE WG79, related RTCA SC-213 and EASA in charge of developing and updating MASPS-level guidance for Synthetic Vision Guidance Systems (SVGS), Enhanced Vision Systems (EFVS) and their combination (CVS);
- Weather and separation minima, criteria for operations shall be reviewed by relevant authorities.
- Messages and phraseologies shall be standardised with support of the European regulatory authorities.
- SARPS are to be unified supporting further PCP implementation.
- New EUROCAE standard may be required to support Alternative Ground Surveillance deployment

2.1.4 **Solution 21 - Digital evolution of integrated surface management**

Increasing network capacity (M): The operational implementation of the solution will support a reduction of the Airport capacity loss occurring in adverse weather conditions which in turn will reduce the number of flight plan change requests with respect to the daily schedule.

Access to airports (M): The implementation of the proposed concept of operations will allow a reduction of the airport capacity loss due to disruptive weather conditions, reducing the number of delayed/cancelled flights.

Innovation capacity (L): Flight and airport operations efficiency will benefit from a reduction of speed changes and improved smoothness of surface traffic flows achieved through the implementation of the proposed solution, thus resulting into a benefit for the environment.

Barriers/obstacles:

2.1.4.1 *Barriers/obstacles:*

Limitation of existing operational procedures and systems are a showstopper for maintaining the maximum airport performance capacity level and efficiency in any weather condition. The implementation of the proposed Solution shall contribute to achieve the expected impacts.

2.1.4.2 *Standardisation activities*

Standardisation of Data link messages exchanged between controllers and vehicle drivers, with the support of the EUROCAE WG 78. Standardisation of performance parameters and interoperability for A-SMGCS routing, airport safety support and guidance, supporting EUROCAE WG-41.

2.1.5 **Solution 25 - Safety support tools for avoiding runway excursions**

Access to airports (M): The implementation of the proposed concept of operations will allow a reduction of diversions and runway closures (during runway inspection operations) due to adverse weather conditions, thus reducing the number of delayed/cancelled flights.

Deployment oriented (H): consolidated working method will be developed and validated by an airport operator, responsible for managing runway surface condition assessment and maintenance, to airspace users, to mitigate runway excursion risks.

Innovation capacity (L): potential integration of mobile sensors and use of a runway condition forecast based on mathematical modelling will support actors in enhancing situational awareness at airports, especially in

degraded weather conditions. I may also provide valuable input to arrival & departure management increasing further its accuracy.

2.1.5.1 Barriers/obstacles:

Wave 1 validation activities depended strongly on weather events encountered during the validation period. To mitigate the risk of having sufficient numbers of any of the possible situations, wave 1 data collection has been extended to winter 2018/2019 and this data will be available for wave 2.

Airspace users and airport operators involvement in the validation activities of the solution are mainly expected during workshops.

2.1.5.2 Standardisation activities

Standardisation of runway information systems, combining sensors, models and algorithms, and visualization components that need to provide relevant information (including accuracy/confidence) for airport operators to assess their runways surface condition according to ICAO's Global Reporting Format guidelines at current time, and possibly for short-term prediction, with the support and SESAR solution involvement in the EUROCAE WG 109.

2.2 Measures to maximise impact

2.2.1 Dissemination and exploitation of results

2.2.1.1 Solution 04 - Advanced geometric GNSS based procedures in the TMA

Solution 4 will ensure that all the results from the validation activities will be direct inputs to the overall ATM scientific community and industrial stakeholders. This will be achieved by:

- Development of Validation reports, supporting industrialisation and specification of ANSP needs
- Requirement and specification will be turned into regulatory material either for supporting ICAO, European or national authorities.
- Planned communication activities on regional and global ICAO level.

2.2.1.2 Solution 14 - Evolution of separation minima for increased runway throughput

Solution 14 will ensure all results produced by the project will be direct inputs for regulatory processes and ANSP having to decide what and how to deploy the various OI Steps.

- 2 websites will be created/up-dated (one already on line) for providing all validation results for supporting both industrialisation and specification of ANSP needs.
- Safety analyses and performance analyses will be all developed for being easily reproduced for specific airport environment in support to deployment decision.
- Requirement and specification will be turned into regulatory material for either supporting ICAO, European or national authorities.
- New wake or traffic data will be made available (when not covered by NDA) for being used by industry for deployment or university/research centre for additional investigations.

2.2.1.3 Solution 17 - Improved access to secondary airports

- Technical, operational, cost benefit and validation documents will be available for further development
- Developed prototypes can support demonstration of capabilities and benefits for all ATM stakeholders and the general public
- Results from validation activities can be shared with appropriate standardization bodies and significantly support discussions about new concepts of operations and deployment processes

2.2.1.4 Solution 21 - Digital evolution of integrated surface management

Solution 21 will ensure all results produced by the project will be direct inputs to the overall ATM scientific community and stakeholders. In detail:

- Requirements and specifications will be turned into regulatory material either for supporting ICAO, European or national authorities.
- Performance analysis will be elaborated in support to deployment decision
- All validation results for supporting both industrialisation and specification of ANSP needs.

2.2.1.5 Solution 25 - Safety support tools for avoiding runway excursions

- Shadow – mode validation and its result assures better integration into European ATM environment including standardization and regulation (when applicable).

- SESAR solution involvement in the EUROCAE WG 109 will ensure easy dissemination of the validation results

2.2.2 Communication activities

The project has the following communication goals:

- Create a wide awareness of its specific solutions, their applicability and benefits brought to operations, through conference papers and multimedia communication channels
- Showcase results to the ATM industry stakeholders through open day type activities, and
- Accelerate operational acceptance and deployment through professional forums, conference, articles and open days to show case maturity of operational improvements and technical capabilities

The PJ.02 Coordinator will ensure alignment with SJU guidance on communication activities to validate messages and support for outreach through SESAR communication channels including web provision, conferences and events, and reaching out to partner's communications point of contact.

Key stakeholders for this project include Ground Industry, Air Industry, ANSP and Airports.

Partners web sites and communications capabilities will be used.

Calendar of Communication events have been aligned with project milestones:

Solution	Dissemination and communication activities per solution										Type of audience									
	Organisation of a Conference	Organisation of a Workshop	Press release	Non-scientific and non-peer reviewed publication (pre validated publication)	Exhibition	Social Media	Website	Participation in a conference	Video/Film	Participation in activities organized jointly with other H2020 projects	Scientific Community (Research)	Industry	Civil Society	General Public	Policy Makers	Media	Investors	Customers	Aircraft Manufacturers	
Solution 04				Q2 2022		Q2 2020	Q4 2020	Q2 2021				Yes		Yes	Yes			Yes		
						Q4 2020	Q4 2021	Q4 2021												
						Q2 2021	Q4 2022	Q2 2022												
						Q4 2021		Q4 2022												
						Q2 2022														
Solution 14	Q2 2022	Q3 2020		Q3 2021	Q2 2021	Q2 2020	Q4 2020	Q3 2020	Q3 2022	Q2 2021	Yes	Yes			Yes	Yes		Yes		
		Q3 2021				Q4 2020	Q4 2021	Q3 2021	Q3 2022											
		Q3 2022				Q2 2021	Q4 2022	Q3 2022												
						Q4 2021														
						Q2 2022														
Solution 17						Q4 2021			Q4 2022		Yes	Yes				Yes		Yes	Yes	
						Q4 2022														
Solution 21		Q2 2020		Q2 2020	Q2 2021	Q1 2021		Q3 2021		Q2 2021	Yes	Yes			Yes	Yes		Yes		
		Q3 2021		Q3 2021	Q2 2022	Q2 2021		Q3 2022												
		Q1 2022		Q1 2022		Q3 2021														
						Q4 2021														
Solution 25	Q1 2022	Q3 2020	Q1 2022			Q1 2022			Q1 2022		Yes	Yes						Yes		
		Q3 2021				Q2 2020														
		Q3 2022				Q4 2020														
						Q2 2021														
						Q4 2021														

3 Implementation

3.1 Work plan — Work packages and deliverables

3.1.1 Overall structure of the work plan

The project is organised into seven workpackages covering five different Solutions; each split into a number of activities and to a certain extent, coordinated independently by its Solution Leader. The project structure is displayed in Figure 1.

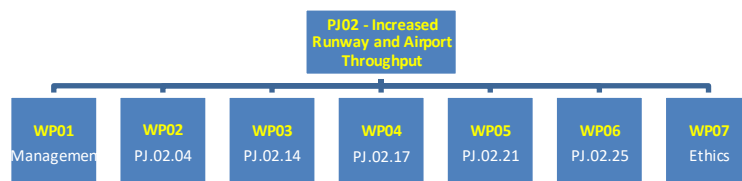


Figure 1: PJ02 Work Break Down Structure

In order to ensure coordination and performance of the activities related to transversal activities, a Project Content Integration Team, (PCIT) represented by solution ATM focal points led by the Project Content Integration Leader (PCIL) will coordinate with transversal projects in order to ensure coherency of solutions contributions. See section 3.2. for further detail. A detailed work package description follows in chapter 3.4.

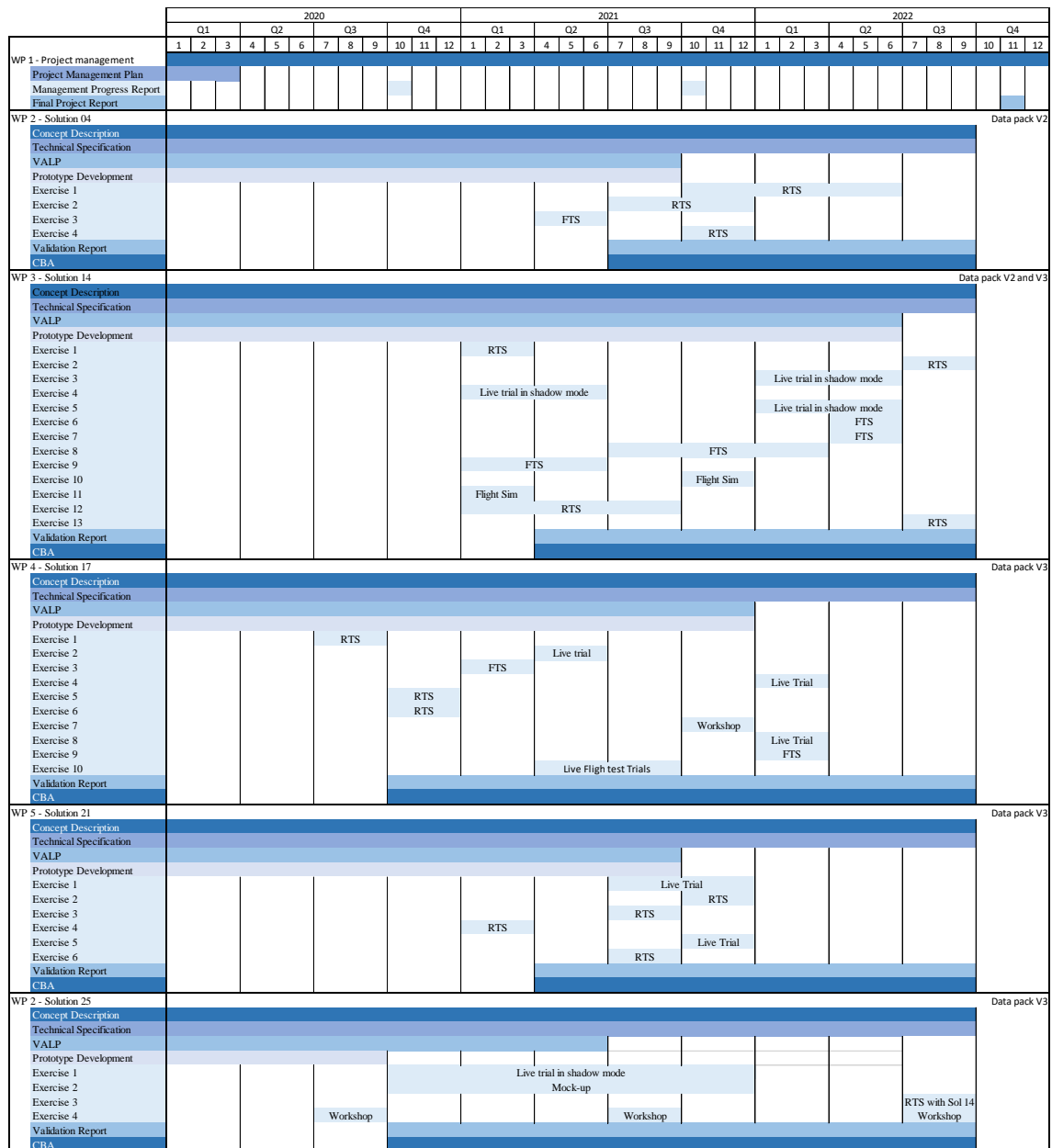


Figure 2: Project PJ02 Gantt: Timing of the different work packages

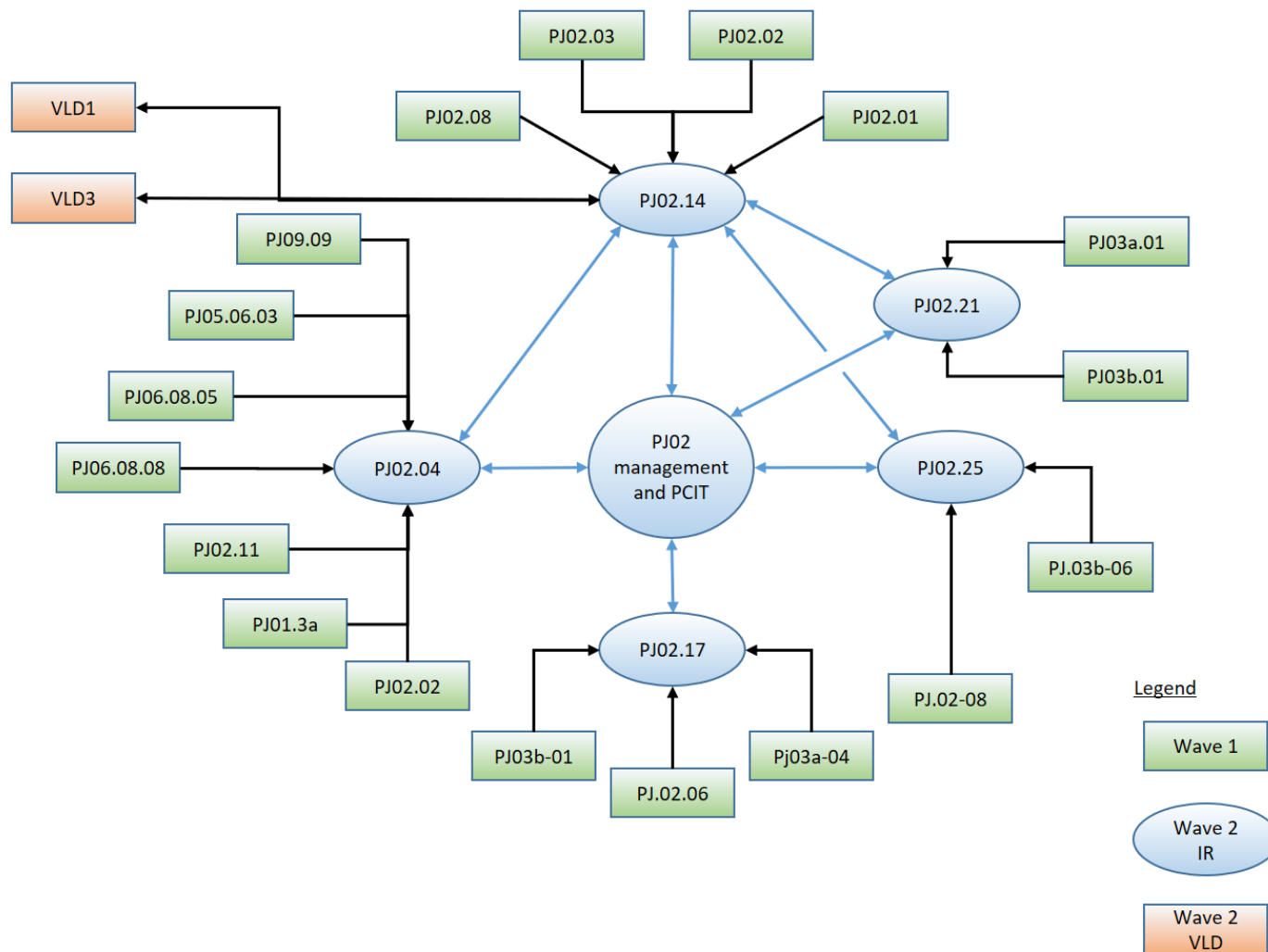


Figure 3: Project PJ.02 Pert Diagram

3.2 Management structure, milestones and procedures

A lean and efficient management structure will be applied that allows for fast decision making to ensure that the pursued objectives are met. The SESAR2020 Management Agreement (SMA) will specify management rules that govern the project's workflow as well as all responsibilities and duties of the partners during the course of the project. The SMA will be negotiated and signed before the project starts. All of the administrative and organisational management activities are hosted in WP00. This approach will allow an effective and efficient assignment of partner contributions, while facilitating separation of research and technology tasks from the administrative work necessary to carry out the project.

The project management structure is composed of two main levels that are presented in Figure 4.

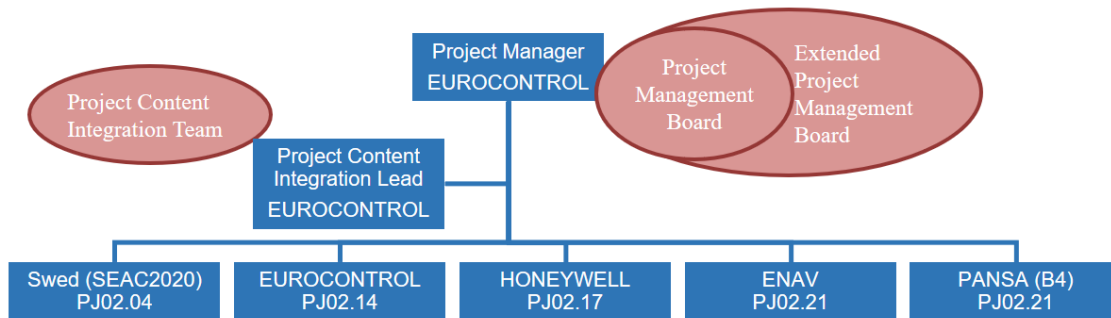


Figure 4: Project Structure for Solution/Enabling Project

The combined legislative-executive level is composed of the Project Manager (PM) and a set of dedicated panels. The PM, as a central point of reference, participates in the Project Management Board, ensuring the overall coordination and follow-up of Project activities. The PM reports to the SESAR Joint Undertaking (SJU) on behalf of the project partners. The Project Content Integration Team Lead (PCILT) ensures that the project content information is consistent across solutions. At the implementation level, Solution Leaders (SLs) manage the execution of technical development and control implementation steps.

3.2.1 Project Manager (PM)

The **Project Manager** acts as the Specific Grant Agreement point of contact (SGA Coordinator) with the SJU for all contractual matters, and is responsible for:

- Checking the quality of the deliverables and verifying their completeness and correctness;
- Submitting the deliverables and reports on behalf of the SGA beneficiaries;
- The escalation of issues relevant to the Grant Agreement or to the overall SESAR Programme and management of changes to the Grant Agreement;
- Preparing and contributing to the formal contractual closure of the activity.

In addition, the **Project Manager** is responsible of:

- the timely delivery of the SESAR Solutions or Technological Solutions and Enablers for IRs projects
- the timely execution of SESAR Solution validation activities for IRs projects;
- the preparation, execution and maintenance of a Project Management plan;
- the application of common methods, as defined within the Programme Management Plan (e.g. progress reporting, corrective action implementation, project control gates);
- the provision of a comprehensive oversight of the Project and management of the operational relationship between the Members involved at the Project level;
- ensuring with partners the engagement of 3rd parties (such as but not limited to airspace users, staff associations, etc.), where applicable;
- Escalation of issues internal to the Project that cannot be resolved by the PMB to the contribution managers of the Project Partners;
- proper and timely communication of information, within and outside of the Project; and
- an appropriate preparation and contribution to the operational closure of the Project.

3.2.2 Project Management Board (PMB)

The Project Management Board will ensure that all key management decisions of the project are taken with the full support of contributors of the projects. Decision will be made by consensus of all partners involved in a given solution or work package, or in the project if the decision applies to the whole project. In case of disagreement, the escalation process foreseen in Appendix F of the SJU Membership Agreement will apply.

The Project Management Board should meet periodically (WebEx or Face to Face as required) to:

- review progress of the project;
- decide corrective actions;
- review project risks and associated mitigation actions;
- review any potential Change Request to the SGA when necessary.

The Project Management Board will be composed of:

- Project Manager (chairman);
- Project Content Integration Lead : EUROCONTROL
- Solution Leaders or WP leaders;
- Representatives of key contributor to the project (if not represented by above categories).

SJU may be invited for specific agenda items.

3.2.3 Extended Project Management Board (EPMB)

An Extended Project Management Board meeting (including all contributors of the project) will need to be convened annually at a minimum. SJU may be invited for specific agenda items.

In addition in case of significant changes to the project, the Extended Project Management Board shall be asked for approval by correspondence, e.g. for:

- critical deliverables of the project :
 - Initial PMP and updates
 - CBAs (approved by contributors to the solution)
 - V Data Pack
- Change Request to the SGA.

Decision making principles are the same as for the Project Management Board.

3.2.4 Solution Lead (SL)

The Solution Leader is the person responsible for the operational and technical leading of the solution. He/She is responsible for the SESAR Solution refinement, the overall management of related validation activities and timely delivery of the Solution deliverables. In particular, the Solution Leader will:

- Organise and coordinate the activities of the Solution Team;
- Report to the Project Manager on progresses and issues;
- Make proposal for update and amendments of the validation roadmap, to be agreed at project level;
- Ensure consistency within the solution and in particular of the different deliverables in support of the different maturity evolution/levels (V1, V2 and V3);
- Prepare and represent the solution at the maturity gate, notably responsible for producing the Maturity Report;
- Participate to the PMB/EPMB.

3.2.5 Solution Team

The main role of the Solution Team is to:

- Define, validate the SESAR Solution and produce the associated deliverables and prototypes. A Project validation roadmap will be agreed at project level. The Solution Team will conduct validations according to the agreed roadmap.
- Identify and initiate required changes to the SESAR Solution, including the validation roadmap.
- Contribute, under the coordination of the Project Content Integration Lead, to update the relevant sections of Transversal Projects deliverables.
- The Solution Team is composed of all contributors to the work of a given Solution.

3.2.6 Project Content Integration Lead (PCIL)

The Project Content Integration Lead:

- Reports to the Project Manager
- Coordinates and organises the work of the Project Content Integration Team
- Acts as a focal point for interaction with the Transversal Projects, supported by the Project Content Integration Team. Is in particular the focal point for the project's change requests to the project content information.
- The effort of the PCIL is allocated to WP01.

3.2.7 Project Content Integration Team (PCIT)

The Project Content Integration Team is a virtual team composed of the ATM Focal Points, relevant experts from the Solution Teams.

- The role of the Project Content Integration Team is to ensure the technical and operational consistency between the different solutions developed in one project, consistency with dependant Solutions in other Projects and to coordinate interactions with Transversal activities. It ensures that the outputs provided by the projects are compliant with the guidance material provided by Transversal Projects. It shall identify and seek for solutions for any gaps or conflicting choices between the solutions of the project in order to ensure the project fulfils its objectives. It also supports the Project Manager for the organisation of the technical gates, and for the communication of project results.

3.3 Consortium as a whole

The members of the SESAR Joint Undertaking PPP work and cooperate together to the best of their abilities with a view of implementing SESAR 2020 in a correct, efficient, open and timely manner and of attaining the objectives and the deliverables as envisaged by the ATM Master Plan. The Consortium involves key stakeholders of the Airborne Systems, Ground ATM Systems, Service Provision and EUROCONTROL hence providing a wide range of expertise covering all aspects of EUROPEAN ATM.

At the time of submitting this proposal, this consortium comprises 17 active organisations from 9 member states of the European Union, and 2 organisations from 1 nation beyond the EU. The consortium was carefully selected according to the skills and experiences required to accomplish the proposed work. The operational expertise, which is crucial for the conceptualisation and implementation phase of the project, is found in the strong representation of end-user organisations in the consortium. The work is structured in a very collaborative way throughout all work packages and will ensure the transfer of knowledge and know-how between all participants.

As presented in the

Figure 5, the PJ02 effort is perfectly balanced between Service Providers ensuring identification of real operational needs, Airborne and Ground industry for the future hand-over to product development and EUROCONTROL ensuring know-how transfer and consistency in the validation method.

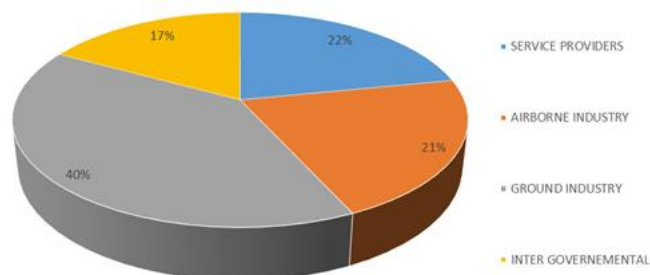


Figure 5: PJ.02 - Partnership Distribution

3.4 Resources to be committed

As per Sections 2.4 and 2.5 of the SJU Single Programming Document 2019-2021, *“It is also envisaged that the same grant budget amendment procedure used for Wave 1 projects will be applied for Wave 2 projects in 2020”*.

Therefore, the SJU contribution to the Action shall be broken down into several instalments.

The first instalment (“First SJU Contribution” of the Action), corresponding to the initial “maximum grant amount” as per Article 5.1 of the Grant Agreement, will be calculated in proportion of:

- the maximum grant amount after evaluation for the Action,
- the number of grants awarded under the IR call, and
- the 95 M€ SJU budget available.

On the basis of the First SJU Contribution for this Action established at a maximum grant amount of 10,628,009.21 EUR it is clarified that as a consequence, at the date of signature of the Grant Agreement and without prejudice to the total amount of the budget agreed for this Action, notwithstanding the activities described in the Annex 1, the work to be performed under the First SJU Contribution as per Article 5.1 of the Grant Agreement is limited as summarized below:

- GEN - Requirement No. 1
- H - Requirement No. 2
- POPD - Requirement No. 3
- Project Management Plan
- Management Progress Report 2020

Any further SJU contribution resulting from further budget availability, will be implemented through a Grant Amendment as per Sections 2.4 and 2.5 of the SJU Single Programming Document 2019-2021, and will result in an update of the Maximum Grant amount in Article 5.1 of the Grant Agreement.

The Grant Amendment shall also modify article 21 of the Grant Agreement with an update of the pre-financing payment for the Action. The level of SJU contributions and pre-financing of the grant amendments will be established in accordance with the SJU Single Programming Document (SPD) as approved by the Administrative Board.

In the event of unavailability of further SJU Budget, beneficiaries may terminate their participation in the action as per article 50.2 and this shall not be regarded as a case of improper termination.

3.4.1 Table 3.4b: 'Other direct cost' items (travel, equipment, other goods and services, large research infrastructure)

3 / PANSa (B4)	Cost (€)	Justification
Travel	€105 869,05	PANSa, together with its three LTPs, will contribute to two Solutions. PANSa will perform the role Solution Lead in Sol #25. All the above factors lead to these amount, which covers expenses of PANSa and LTPs for estimated 45 international and 25 domestic travels in total (e.g. for technical, coordination, validation meetings) for the duration of the project. Estimated unit cost round EUR 1880/international trip and round EUR 850/ domestic trip.
Equipment	€106 920,00	The amount covers: equipment depreciation used by project team (workstations with GPUs for ML development, laptop computers, dedicated 2U server for model validation), additional optical sensor for coverage detection, ARWIS system installation in Gdańsk Airport, other low-value additional equipment and materials
Other goods and services	€173 844,92	The amount covers: data necessary for validation, publication costs, HPC access costs, audits, access to airport locations (validation platform) for system component installation, cost of performance of the day-to-day operational duties with validation equipment installed, access to airport-related runway data, access to Boschung Ice Alert runway sensor data, costs of final H2020 Certificate of Financial Statements, services related to validation, hardware transportation/delivery
Total	€386 633,97	
4 / LFV/COOPANS	Cost (€)	Justification
Travel	€ 80.000,00	Many meetings are held in other countries. To be able to participate it often requires a higher cost for LFV/COOPANS, since Personnel has to travel a day in advance to be there in time. The distance to other countries in Europe is also a factor for higher costs. Estimated number of travels is 53.
Equipment	€ 25.701,00	LFV/COOPANS is planning to facilitate validation exercises. To be able to do so, LFV/COOPANS expect to have additional costs for equipment depreciation.
Other goods and services	€ 33.240,00	H2020 audit costs of final H2020 Certificate of Financial Statements, catering for meetings at LFV/COOPANS premises with external guests and contracting external company to provide a service – delivery of resources to be engaged in the work integrated as if they were internal LFV resources, provided with the same access to facilities and systems as employees at LFV (mainly former employees)
Total	€138 941,00	
9 / HC (FSP)	Cost (€)	Justification
Travel	€43 200,00	Travel costs are based on HC (FSP)'s participation at validation activities, project or solution meetings, coordination meetings, integration work, tests and preparation work at non-HC (FSP) site. Trips for PJ02-

		W2 includes an average of 5 travels/year for 2-3 person, on the approximated cost of €1400 per travel and person.
Equipment	€0,00	-
Other goods and services	€1 400,00	<u>Marketing and representation:</u> Publicity for the results of the solution (electronic press, social media etc.) Catering for meetings at HC (FSP) premises
Total	€44 600,00	

12 / LDO	Cost (€)	Justification
Travel	€ 40000,00	It is foreseen in average that two people will travel to the validation site at least 10 times a year for a short mission (one to three days) during the lifetime of the project, and therefore LDO needs to bear the necessary trip and accommodation costs.
Equipment	€ 60000,00	Hardware equipment and software licenses will be completely dedicated to the project for a forecast duration of 2.5 years. Therefore the related decrease of value of such goods needs to be considered here.
Other goods and services	€ 23186,00	Workshop Activities, Open Days, Courses
Total	€ 123 186,00	

17 / Swed (SEAC2020)	Cost (€)	Justification
Travel	€ 15.000,00	Travel costs to meetings, workshops, validations. The meetings will be held in different countries. The estimated number of travels is 5, numbers of participants vary from 2 to 6 travellers. The average cost per mission and per person is around 800€.
Equipment		
Other goods and services	€ 91.000,00	Project research support within Work Package 2 will be given by external project resource. The resource possesses technical skills necessary for the action, not available within Swedavia. 'Contribution is charged on an hourly basis'.
Total	€106 000,00	

4 Members of the consortium

4.1 Participants (applicants)

4.1.1 Companies profile

4.1.1.1 EUROCONTROL – European Organisation for the safety of Air Navigation

Organisation	1	EUROCONTROL	Intergovernmental Organisation
Description	<p>EUROCONTROL, the European Organisation for the Safety of Air Navigation, is an intergovernmental Organisation with 41 Member States, committed to building, together with its partners, a Single European Sky that will deliver the ATM performance required for the 21st century. EUROCONTROL employs more than 1,900 highly qualified professionals spread over four European countries. Their expertise is deployed to address ATM challenges in a number of key roles:</p> <ul style="list-style-type: none"> • The Network Manager has extended the role of the former Central Flow Management Unit to proactively manage the entire ATM Network (nearly ten million flights every year), in close liaison with ANSPs, airspace users, the military and airports. • The Maastricht Upper Area Control Centre provides air traffic control services for the Netherlands, Belgium, Luxembourg and northern Germany. • The Central Route Charges Office handles billing, collection and redistribution of aviation charges. • It provides a unique platform for civil-military aviation coordination in Europe. • EUROCONTROL is a major player in European ATM research, development and validation and in this respect makes the largest contribution to the SESAR Joint Undertaking. • EUROCONTROL is supporting the deployment through contributions to the Deployment Programme and is supporting the European Commission, EASA and National Supervisory Authorities in their regulatory activities. 		
Previous experience	<p>Publications:</p> <ul style="list-style-type: none"> • 37th DASC Digital Avionics Systems Conference, "Simulations investigating curved departure and arrival procedures using GNSS based vertical guidance", D. De Smedt, F. Behrend, September 2018, London, United Kingdom • 34th DASC Digital Avionics Systems Conference, "Simulations Investigating Combined Effect of Lateral and Vertical Navigation Errors on PBN to xLS Transition", D. De Smedt, E. Robert, F. Behrend, September 2015, Prague, Czech Republic • 33rd DASC Digital Avionics Systems Conference, "RNP To Precision Approach Transition Flight simulations", D. De Smedt, E. Robert, F. Behrend, October 2014, Colorado Springs, USA • JOURNAL OF AIRCRAFT, Vol. 52, No. 3, May–June 2015, Improved Understanding of En Route Wake-Vortex Encounters, Mike 		

	<p>Hoogstraten, Hendrikus G. Visser, Dennis Hart, Vincent Treve,§ and Frederic Rooseleer</p> <ul style="list-style-type: none"> • Eleventh USA/Europe Air Traffic Management Research and Development Seminar (ATM2015), The current practice of separation delivery at major European airports, Gerben van Baren, Catherine Chalon-Morgan, Vincent Treve • Eleventh USA/Europe Air Traffic Management Research and Development Seminar (ATM2015), A Simple Wake Vortex Encounter Severity Metric, Ivan De Visscher, Grégoire Winckelmans, Vincent Treve • 34th DASC Digital Avionics Systems Conference 2015, Prague. Typical additional Spacing buffer to apply at 4DME for delivering separation minima; F.F. Herrema, V. Treve and prof R. Curran • De Visscher, I.; Winckelmans, G. & Treve, V., Characterization of Aircraft Wake Vortex Circulation Decay in Reasonable Worst Case Conditions, AIAA SciTech, 54th AIAA Aerospace Sciences Meeting, paper AIAA 2016-1603, San Diego, California, USA, 4-8 January 2016 <p>Previous projects:</p> <ul style="list-style-type: none"> • SESAR 2: PJ.02-02, PJ.02-11, PJ.01-03 • SESAR 1 : 6.8.1 Project Coordinator, 6.8.8 • CREDOS • OPTIMAL Project • A380 and B747-8 Wake Turbulence Working Group • RECAT-EU • Time Based Separation • ATC-Wake • I-Wake
<p>Entity Profile matching the task</p>	<p>EUROCONTROL will co-ordinate the project and provide its expertise from previous project in different area covering mainly wake & PBN expertise, safety, human factor and validation. EUROCONTROL proposes to use its Fast Time Simulation facilities and tower validation platform composed of an advanced controller working position used in different SESAR validations.</p> <p>EUROCONTROL will provide expertise in:</p> <ul style="list-style-type: none"> Project and Program Manager Wake expert Safety experts Human Factor experts

	Real Time and Fast Time simulation experts Flight Ops and PBN experts
Contribution	<p>Solution 4:</p> <p>EUROCONTROL will organise the cockpit simulations proposed for Solution 4 as well as contribute to expert group meetings and liaise with European or international standardisation groups/panels.</p> <p>Solution 14:</p> <p>EUROCONTROL will lead the solution and the concept development, validation plan, validation report and CBA plus 3 RTS, flight simulations and live trial supporting all OIs covering optimised separation design and optimised separation delivery.</p> <p>Solution 17:</p> <p>EUROCONTROL will contribute to the Honeywell validation exercise by providing the required data through the aeronautical dataset service developed in Wave 1.</p>

4.1.1.2 AIRBUS SAS

Organisation	2	AIRBUS	Airborne Industry
Description	<p>Airbus is a leading global manufacturer of the most innovative commercial aircraft. Its comprehensive product line comprises highly successful families of aircraft, from the single-aisle A220 Family to the double-deck A380.</p> <p>Over the last years, Airbus has built a reputation on reacting to market demands, developing and evolving its products to meet the needs of customers and the wider world. As such, technological innovation has been at the core of Airbus' strategy since its creation.</p> <p>The A320 is one aircraft in four sizes (A318, A319, A320 and A321), representing the most successful and versatile jetliner family ever. Seating from 100 to 240 passengers and flying throughout the world – and landing on every continent – an A320 takes off or lands every 1.6 seconds. The A320neo (new engine option) is the latest upgrade to the A320 Family. These new A319, A320 and A321 models feature new engines and large wingtip devices known as Sharklets. Together they result in a 15% fuel-burn reduction, corresponding to an annual CO2 reduction of 3,600 tonnes per aircraft. The A220 expand the Airbus single-aisle family to cover the 100-150 seat segment – and respond to a worldwide market demand for smaller single-aisle jetliners.</p> <p>In the wide-body segment, the A330neo is powered by high-bypass ratio, new generation engines and designed with an advanced high-span wing vastly improving the aerodynamics. New materials have also been used across the wing including titanium pylon and composite nacelle. All these features combined, ensures that the A330neo has the lowest seat-mile cost of any mid-size wide body and burns 25% less fuel burn than the previous generation A330.</p> <p>The A350 XWB brings together the very latest in aerodynamics, design and advanced technologies to shape the efficiency of medium- to long-haul operations. The aircraft's innovative all-new carbon fibre reinforced plastic</p>		

	<p>fuselage results in lower fuel burn as well as easier maintenance. Meanwhile, the combination of low operating costs, flexibility and optimised performance makes the A330 Family popular with an ever-increasing operator base.</p> <p>The A380 provides airlines with the best opportunities to optimise revenue across their networks, with more seats for growth, connecting traffic and higher yields by offering more capacity when and where people want to fly.</p> <p>Continuously striving to develop new technologies, Airbus is a world leader in the modern aviation industry. Helping it stay at the forefront is the introduction of new systems, materials and designs that improve the quality and efficiency of aircraft to benefit everyone – from the passengers to airlines.</p>
Previous experience	<p>Since 2005, Airbus is full member of the SESAR Joint Undertaking. Throughout the SESAR Definition Phase to the execution phase, AIRBUS has demonstrated its dedication and commitment to the SESAR 1 Programme, participating in more than 300 projects within the Programme and leading both WP9 (Aircraft), as well as playing a key role in many projects under WP3 (Validation Infrastructure Adaptation and Integration), WP4 (Enroute operations), WP5 (TMA operations), WP6 (Airport operations) and WP15 (CNS) and to SESAR 2020 Wave 1 Programme (PJ01 Arrival/Departure, PJ02 Airport throughput, PJ03a Surface management, PJ03b Airport Safety, PJ10 Separation management, PJ11 ACAS-X, PJ14 CNS, PJ17 SWIM, PJ18 4D Trad management, PJ19 Content Integration and PJ20 Master Plan, and leading VLD DIGITS and DIGITS AU)</p> <p>Relevant Airbus Expertise for PJ02</p> <p>Airbus has thorough ATM knowledge of commercial air transport operations. In the frame of SESAR 2020 wave1, Airbus has been deeply involved in many activities related to Airport airside and runway throughput through the following projects:</p> <ul style="list-style-type: none"> • Key contribution on the evolution of separation minima for increased runway throughput in Wave 1 through solutions #02-01 and #02-08. • Key contributors for operational concept definition, airborne solutions and validations in the Project PJ03b-06: “Safety support tools for avoiding runway excursions”. <p>More specifically for this operational project, Airbus has key expertise Wake vortex study.</p> <p>Beyond the expertise on wake vortex risk modelling and severity assessment developed in its different aircraft programs, Airbus has been involved in a number of R&T projects on the subject (S-WAKE, FLYSAFE, CREDOS...) and has been leading a network of excellence (WAKENET3-Europe). Airbus is also involved in the ICAO Wake Turbulence Steering Group (WTSG) and providing support to the EUROCONTROL Wake Vortex Task Force (WVTF) to elaborate a Recategorization of wake turbulence separations. Airbus will bring to the project all this expertise, as well as its experience in SESAR Execution Phase P6.8.1 (Enhanced arrival procedures to reduce occupancy time using GBAS) and as leader of project 09.11 (Aircraft Systems for Wake Encounter Alleviation).</p> <p>Furthermore Airbus has been strongly involved in runway excursion through:</p>

	<ul style="list-style-type: none"> • Runway Overrun Awareness and Avoidance System (ROAAS) solution for All Airbus aircraft; • Take-Off Securing (TOS) and Take-Off Monitoring solutions • Airborne solution for the Improvement of Runway braking conditions using aircraft data, for Airport Operators, ATC operational usage and for Airline Operations <p>Airbus has been strongly involved for the A400M military transport aircraft in the Enhanced Vision System (EVS) and for civil aircraft, on an Head Up Display (HUD) System ready for future technologies such as Enhanced Vision Systems (EVS), Synthetic Vision Systems (SVS).</p>
Entity Profile matching the task	As the leader aircraft manufacturer, capable of managing large complex programmes, AIRBUS staffs are highly skilled professionals, competent and motivated in their fields and well accustomed to working within an international, multicultural environment.
Contribution	<p>AIRBUS will contribute to solutions PJ02 solution 14, solution 17 and solution 25.</p> <p>For detailed Airbus contribution description, please refer to section 3 of this Technical Annex.</p> <p>Of course, as the major global aircraft manufacturer, capable of managing large complex programmes, Airbus is also ready and willing to lead the Airborne Industry Coordination</p> <p>The Airbus contribution is principally in terms of airliner flight deck system design, integration and validation, but with its substantial operational and systems development experience, Airbus also intends to participate to the development and validation of operational elements. Finally, Airbus offers the facilities and equipment, necessary to enable participation of large airliners within a live trials environment.</p> <p>More specifically for PJ02-solution 14, Airbus will contribute to the V2 concept description and validation and CBA and performance assessment. Airbus will develop airborne prototype and propose FTS.</p> <p>For PJ02 solution 17, Airbus will also contribute to the V3 concept description and validation and CBA and performance assessment. Airbus will develop airborne prototype and propose Flight trials.</p> <p>For PJ02 solution 25, Airbus will also contribute to the V3 concept description and validation and CBA. Airbus will develop airborne prototype and propose extensive testing (Shadow mode for runway braking action).</p> <p>For detailed Airbus contribution description, please refer to section 3 of this Technical Annex.</p> <p>Of course, as the major global aircraft manufacturer, capable of managing large complex programmes, Airbus is also ready and willing to lead the Airborne Industry Coordination.</p>

4.1.1.3 RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK

Organisation	20 ANS CR (B4)	Service Provider
Description	<p>Air Navigation Services of the Czech Republic (ANS CR) is a progressive provider of safe and cost-effective air traffic services designated by Czech Ministry of Transport. Its task is to provide services to airspace users within the Czech airspace and at 4 international airports - Prague, Brno, Ostrava and Karlovy Vary. Covering rather small but very complex airspace, the company handled more than 850.000 flights in 2017, reaching to 900.000 flights in 2018, with minimal level of delay.</p> <p>Operating fleet of jet and propeller calibration aircraft, ANS CR offers wide range of flight inspection services. In addition, ANS CR provides specialized aviation training. The portfolio includes ATC training, pilot and other aviation staff training using its own facilities including ATC and aircraft simulators. The above-mentioned activities together with ATM consultancy services are provided to international customers on commercial basis by subsidiary companies CANI (Czech Air Navigation Institute) and CATC (Czech Aviation Training Centre).</p> <p>Being member of SESAR Joint Undertaking via B4 Consortium, ANS CR actively contributes to SESAR 2020 Programme. Participation in SESAR Deployment Programme is ensured by involvement in several implementation projects. Together with other central European countries the Functional Airspace Block Central Europe (FAB CE) was formally established. All such activities contribute to implementation of the Single European Sky (SES) legislation.</p>	
Previous experience	Not applicable	
Entity Profile matching the task	Not applicable, ANS CR initially will not participate directly in this action.	
Contribution	Support to participating members of B4 Consortium if required.	

4.1.1.4 LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK

Organisation	21 LPS SR (B4)	Service Provider
Description	<p>Founded by the Ministry of Transport, Construction and Regional Development of the Slovak Republic in January 2000, LPS SR (Letové prevádzkové služby Slovenskej republiky, štátny podnik) is a state enterprise providing Air Navigation Services, including Air Traffic Services, Aeronautical Telecommunication Services, Aeronautical Information Services, as well as Search and Rescue, in the Slovak Republic.</p> <p>With a total staff of 500 (including 118 ATCOs) and altogether nine Operational units, among them one ACC (Bratislava), two APPs (Bratislava, Košice), five TWRs (Bratislava, Košice, Piešťany, Poprad, Žilina) and Central ATS Reporting Office (Bratislava), LPS SR controls the Slovak airspace (Bratislava FIR) of the total size of 48,800 km² and provides ATC services at five designated Slovak international airports as well as within small parts of the Hungarian airspace.</p> <p>In 2017, compared to the previous year, an increase in traffic was seen in the FIR Bratislava, namely from 505,155 to 522,353 movements, i.e. by 3.4%. August 5 was the day with the highest number of movements; on that day LPS SR provided air navigation services to record-breaking 2,163 flights. The European-wide increase in air traffic is also reflected in the evolution seen in</p>	

	<p>the Slovak airspace in the last decade when the total number of movements increased by 59%.</p> <p>As far as provision of air traffic control is concerned, there were no delays which would exceed the determined limit of 0.5 minute per 1 flight. The average delay was only 0.039 minutes per flight.</p> <p>LPS SR is a part of B4 Consortium, Member of SESAR Joint Undertaking.</p> <p>LPS SR is a Member of the FAB CE and a founding member of the Gate One, a regional platform of Central and Eastern European ANSPs.</p>
Previous experience	Not applicable
Entity Profile matching the task	Not applicable, LPS SR initially will not participate directly in this action.
Contribution	Support to participating members of B4 Consortium if required.

4.1.1.5 VALSTYBES IMONE ORO NAVIGACIJA

Organisation	22 ON (B4)	Service Provider
Description	<p>Founded by the Ministry of Transport and Communications of the Republic of Lithuania in 1995, valstybes imone Oro navigacija (ON) is a state-owned enterprise providing Air Navigation Services, including Air Traffic Management Services, Communication, Navigation and Surveillance Services, Aeronautical Information Services, as well as Search and Rescue, in the airspace of Republic of Lithuania and over the part of Baltic Sea.</p> <p>With a total staff of 290 (including 90 ATCOs) and altogether five operational units, among them one ACC (Vilnius), three APPs (Vilnius, Kaunas, Palanga), one TWR (Siauliai), ON controls the airspace of Republic of Lithuania and over the part of Baltic Sea (Vilnius FIR) of the total size of 76 126 km2 and provides ATC services at four designated Lithuanian international airports.</p> <p>In 2018, compared to the previous year, an increase in air traffic was seen in the Vilnius FIR, namely from 243,022 to 265,919 IFR movements, i.e. by 9.4 %. The European-wide increase in air traffic is also reflected in the evolution seen in the airspace of Republic of Lithuania in the last decade when the total number of IFR movements increased by 47%. Each year providing safe and efficient air traffic control services to more than 250 thousand flights ON continues to maintain zero delays level and to meet users' expectations.</p> <p>ON is a Member of Baltic FAB, a part of B4 Consortium composed of four ANSPs from Central and Eastern European countries and a Member of SESAR Joint Undertaking. Being a member of SESAR Joint Undertaking via B4 Consortium, ON actively participates in the industrial and transversal projects by SESAR 2020 Programme while participation in SESAR Deployment Programme allows to implement several projects. In 2017, ON officially joined the European iTEC (Interoperability Through European Collaboration) alliance developing a high-end air traffic management system for busy and complex airspace.</p>	
Previous experience	Not applicable	
Entity Profile matching the task	Not applicable, Valstybes imone "Oro navigacija" initially will not participate directly in this action.	
Contribution	Support to participating members of B4 Consortium if required.	

4.1.1.6 POLSKA AGENCJA ZEGLUGI POWIETRZNEJ

Organisation	3	PANSA (B4)	Service Provider
Description	<p>PANSA (Polish Air Navigation Services Agency) is the national entity acting pursuant to the Act on the Polish Air Navigation Services Agency (2006) to provide air navigation services in Poland. PANSA provides air traffic management services, communication, navigation and surveillance services as well as an aeronautical information services in the Polish airspace and in airspace over the part of Baltic Sea. It operates one combined En-route/TMA control centre at Warsaw, 3 independent TMA control centres (Gdańsk, Kraków, Poznań) and 14 tower units at Polish international airports. Each year PANSA, being one of the biggest ANSPs in the Central and Eastern part of Europe, provides safe, effective and highly efficient air traffic control services.</p> <p>In 2018 PANSA handled over 830 thousands movements (IFR traffic).</p> <p>PANSA is constituent entity of B4 Consortium, composed of four ANSPs from Central and Eastern part of Europe and their Linked Third Parties. B4 Consortium is a member of A6+ on SESAR 2020 Programme content.</p> <p>PANSA is a Member of the Baltic FAB and Gate One, a regional platform of Central and Eastern European ANSPs.</p> <p>PANSA is also a founding member of the SESAR Deployment Alliance that was mandated by the European Commission to perform functions of the SESAR Deployment Manager that is responsible for synchronisation and coordination of PCP-related implementation projects.</p>		
Previous experience	<p>Until now PANSA has successfully been working on various airport projects, underlining the activities, which are focused on keeping the ATC service at the effective level. The expertise includes number of experts working on different kind of automation of airport services. Special attention is being drawn to the secondary airports, where PANSA puts its significant footprint, especially in provision of assistance to flight crew starting from procedures to equipment.</p> <p>An outstanding PANSA experience is shown in provision of operations in all weather conditions, validating different solutions supporting ATC and crew with focus on reduction of the cost of service.</p> <p>Previous projects:</p> <ul style="list-style-type: none"> ▪ SESAR 2020 Wave 1 PJ.02 EARTH, WP05: “Improved access into secondary airports in low visibility conditions”; ▪ SESAR 2020 Wave 1 PJ.02 EARTH, WP06: “Traffic optimisation on single and multiple runway airports”; ▪ SESAR 2020 Wave 1 PJ.03b SAFE, WP02: “Enhanced Airport Safety Nets for Controllers”; ▪ SESAR 2020 Wave 1 PJ.03b SAFE, WP05: “Safety support tools for runway excursions”; ▪ “Advanced Safety Nets for ATC”: <ul style="list-style-type: none"> ▪ Implementation of advanced safety nets in the PANSA’s ATM system; ▪ “Improved ground safety nets for complex airport environment”, joint project by Warsaw Airport and PANSA <ul style="list-style-type: none"> ▪ Evaluation and implementation of applicable techniques to prevent runway incursions and excursions in the fully dependent operations in the complex, crossing runways, environment; 		

	Implementation of the EFES system (integrated Electronic Flight Progress Strips).
Entity Profile matching the task	<p>PANSA has a long experience in cooperation with airports and joint implementation of solutions aiming increasing runway throughput. It includes, inter alia, operational needs defining, concept of operations, development of solutions, verification and validation processes.</p> <p>PANSA will support the Project with profiles:</p> <ul style="list-style-type: none"> ▪ Tower/airport operational expertise ▪ Human performance and safety expertise ▪ Tower/Airport performance assessment expertise ▪ Procedure design expertise <p>PANSA will bring to the Project PJ.02-W2 vast experience of its Third Parties in the area of:</p> <ul style="list-style-type: none"> ▪ software development in areas: Surveillance Sensor Data Processing and Display, AIM data processing and distribution, Radar Data Processing and Evaluation ▪ constructing vehicle tracking systems based on GPS, ▪ computational and data science, especially in modelling live processes and phenomena, ▪ research and development in the area of runway incursion and monitoring system ▪ MET system laboratory and operational infrastructure (NWP (Numerical Weather Prediction) models, live data, historical datasets of selected data ▪ provision of solutions and efficient modelling of high complexity networks as well as processing large datasets of varying nature, <p>product portfolio of IMS4 product line: AWOS, AWDSS, climatological database, models (NWP, visibility, dispersion/air transport of pollutants, runway status ...), MET radar data processing</p>
Contribution	<p>PANSA will contribute to or lead validation tasks and will provide existing platforms and equipment as well as operational and technical support of its experts (ATC, A-FIS – when applicable, CNS).</p> <p>PANSA will contribute to perform exercises with support of secondary, regional airport with validation platform equipped to perform TWR operations, composed of A-CWP and surveillance sensors, for use in various validations. The platform offers also tracking of the vehicles for full range of exercises.</p>

4.1.1.7 **AUSTROCONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH**

Organisation	23 ACG /COOPANS	Service Provider
Description	<p>Austro Control is a state-owned limited liability company.</p> <p>Location: The headquarter is located in Vienna and subdivisions are situated in Linz, Salzburg, Klagenfurt, Graz and Innsbruck.</p> <p>Organizational setup: Two main divisions - Air Navigation Services (operational functions) comprising Air Traffic Management, Engineering</p>	

	<p>Services, Meteorological Services and Aviation Agency (regulatory matters) supported by corporate services</p> <p>Governance structure: A Supervisory Board and a Management Board are responsible for the corporate governance. An audit committee is also established.</p> <p>The primary business of the ANS part of Austro Control is the provision of air navigation services, pursuing the basic principle of a high level of air traffic safety in compliance with Single European Sky framework</p> <p>Austro Control is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviar and Luftfartsverket (LFV). All five Air Navigation Service Providers have already for a long time been working under a common framework agreement together with Thales in COOPANS. COOPANS is a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research & Innovation by the establishment of the COOPANS Consortium.</p> <p>Austro Control has many years of experience in the delivery of Air Traffic Services, the design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>The enterprise is certified according to ISO 9001.</p>
Previous experience	<p>Austro Control has participated in SESAR via NORACON consortium in the following WPs:</p> <p>WP00 SESAR2020 preparation: 00.15</p> <p>WP3 Validation infrastructure adaptation and integration: 03.03.02, 03.03.03</p> <p>WP5 TMA Operations: 05.03.00, 05.06.02, 05.06.04, 05.06.07, 05.07.02, 05.09</p> <p>WP6 Airport Operations: 06.05.05, 06.06.01, 06.07.01, 06.08.08, 06.09.03</p> <p>WP7 Network Operations: 07.05.04</p> <p>WP8 Information Management: 08.01.01, 08.01.06, 08.03.03, 08.03.06, 08.03.10</p> <p>WP10 En-Route & Approach ATM Systems: 10.02.01, 10.02.03, 10.03.01, 10.03.08, 10.07.01, 10.10.03</p> <p>WP12 Airport Systems : 12.02.01, 12.06.03</p> <p>WP13 Network Information Management Systems: 13.02.02</p> <p>WP14 SWIM Technical Architecture: 14.02.03, 14.04</p> <p>WP16 R&D Transversal Areas: 16.01.01, 16.06.01, 16.06.01.b</p> <p>WP B Target Concept and Architecture Maintenance: B.04.05</p> <p>WP C: Master Plan Maintenance C.02, C.03</p> <p>Austro Control has participated in SESAR 2 Wave 1 in the following Projects, Solutions or VLDs:</p> <p>PJ.01-01</p> <p>PJ.02-01</p>

	<p>PJ.03a-01 PJ.04-02 PJ.05-02 PJ.05-03 PJ.06-01 PJ.09-02 PJ.10-02A PJ.10-02B PJ.16-03 PJ.16-04 PJ.17-08 PJ.18.02 PJ.18.04 PJ.19-CI01 PJ.19-CI02 PJ.20 PJ.24 PJ.27</p>
Entity Profile matching the task	<p>During the development of Airport CDM at Wien Schwechat Austro Control has gained substantial experience in the routing and guidance of aircraft on the surface.</p> <p>Specific expertise relevant for the project:</p> <ul style="list-style-type: none"> • Development and supervision of operational concepts • Safety concepts & Safety Assessments • Airport safety support tools • Collaborative Decision Making • Air traffic forecast/Capacity planning incl. runway capacity enhancement • Development and implementation of ATM systems & Tools (common development and implementation of TopSky) • Trajectory management (core functionality in TopSky) • Flight procedures, special approach procedures (incl. RNAV) • Performance Based Navigation • Validation and Integration • Participation in European deployment activities (IDSG & SDM) • Human Performance Assessment <p>Austro Control has substantial experience with validations and will provide:</p> <ul style="list-style-type: none"> • Air Traffic Controllers • ATM Operational specialists <p>Validation Experts</p>
Contribution	<p>Austro Control will contribute to the project by providing ATM subject matter experts focussing on concept and validation work, such as validation plans and reports (in certain circumstances OSEDs, SPRs and INTEROPs) and by participating in validations with the goal to:</p> <ul style="list-style-type: none"> • Increase a common situational awareness between the ATCOs, the flight crew and vehicle drivers • Increase efficiency to reduce both ATC and cockpit workload and R/T • Improve safety in low visibility conditions.

4.1.1.8 CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD

Organisation	24 CCL /COOPANS	Service Provider
Description	<p>Croatia Control is a state-owned limited liability company.</p> <p>Location: The headquarter is located in Zagreb and subsidiaries are located in Pula, Rijeka, Lošinj, Split/Brač, Zadar, Dubrovnik and Osijek.</p> <p>Divisions: Air Traffic Management, Technical Division, Aeronautical Meteorology, Military Operations and Human Resources Management, Legal and Financial Affairs.</p> <p>Governance structure: An Assembly, a Supervisory Board and main Management. The Assembly consists of the Chairman - the Minister responsible for transport, Minister of Finance and the Minister of Defence. The Supervisory Board monitors the activities of the organization. Supervisory Board appoints the Director General.</p> <p>Director General manages and represents the organization.</p> <p>The primary business of Croatia Control is provision of air navigation services, pursuing the basic principle of a high level of air traffic safety in compliance with Single European Sky framework, and Croatia Control has been certified for provision of the following services:</p> <ul style="list-style-type: none"> • Air Traffic Services (ATS) • Communication, Navigation and Surveillance Services (CNS) • Aeronautical Information Services (AIS) • Aeronautical Meteorological Services (MET) <p>Croatia Control is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviar and LFV. Cooperation between COOPANS partners goes beyond SESAR – partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research & Innovation by the establishment of the COOPANS Consortium.</p> <p>Croatia Control has many years of experience, both in the delivery of Air Traffic Services, design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>Croatia Control is certified ISO 9001, ISO 14001 and BS OHSAS 18001.</p>	
Previous experience	<p>Croatia Control has many years of experience in ATM, ATFCM and ASM, as well in operational use of CPDLC, Mode S and automated system coordination tools in cross border FRA operations which are now an integrated part of the ATM-system Topsky and previously in EUROCAT-E.</p> <p>Croatia Control has participated in SESAR 2020 Wave 1 as a member of COOPANS Consortium in the following projects, solutions or VLDs:</p> <p>PJ.01-01 PJ.04-02 PJ.05-02 PJ.05-03 PJ.06-01 PJ.09-02 PJ.10-02A PJ.10-02B</p>	

	PJ.10-05 PJ.15-09 PJ.16-03 PJ.16-04 PJ.18.02 PJ.18.04 PJ.18-06 PJ.19-CI02 PJ.19-CI05 PJ.20 PJ.24
Entity Profile matching the task	Not applicable, Croatia Control will not initially participate directly in this action
Contribution	Croatia Control will provide support to participating COOPANS members if required.

4.1.1.9 UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY

Organisation	25 IAA /COOPANS	Service Provider
Description	<p>Irish Aviation Authority is a state-owned limited liability company</p> <p>Locations: The headquarter is located in Dublin and subdivisions are located in Shannon and Cork</p> <p>Divisions: Two main divisions - Operations and Strategy, Technology and Training supported by corporate services. Furthermore, Irish Aviation Authority has a Safety Regulation Directorate, as Irish Aviation Authority oversees and regulates the implementation of standards for the Irish civil aviation industry.</p> <p>Governance structure: Irish Aviation Authority has a Board of Directors having responsibility for the corporate governance.</p> <p>Irish Aviation Authority (IAA) is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviair and LFV. Cooperation between COOPANS partners goes beyond SESAR – partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research & Innovation by the establishment of the COOPANS Consortium.</p> <p>Irish Aviation Authority (IAA) has many years of experience, both in the delivery of Air Traffic Services; design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>The enterprise is certified ISO 9001.</p>	
Previous experience	<p>Irish Aviation Authority (IAA) has participated in SESAR via NORACON consortium in the following WPs:</p> <p>WP5 TMA Operations (5.3, 5.6.1, 5.6.4, 5.6.7, 5.9), WP6 Airport Operations (6.7.1), WP 10 En-Route & Approach ATM Systems (10.2.1, 10.3.8, 10.10.3), WP 16 R&D Transversal Areas (16.4.3, 16.6.1), WP C Master Plan Maintenance (C3)</p>	

	IAA has participated in SESAR 2020 wave 1 in the following projects: PJ.10, PJ.16, PJ.17, PJ.25 and PJ.27
Entity Profile matching the task	Not applicable, IAA will not initially participate directly in this action
Contribution	IAA will provide support to participating COOPANS members if required.

4.1.1.10 LUFTFARTSVERKET

Organisation	4 LFV /COOPANS	Service Provider
Description	<p>Luftfartsverket (LFV) is a state enterprise with headquarter located in Norrköping, Sweden. LFV has subdivisions located in 22 different sites, most important being in Stockholm (Arlanda) and Malmö (Sturup), where the two area control centres are located.</p> <p>LFV has three main divisions:</p> <ul style="list-style-type: none"> - Operational Systems & Development - ATM Operations - Sales <p>All supported by corporate services.</p> <p>Governance Structure:</p> <p>LFV has a Board of Directors having responsibility for the corporate governance. The Director general is appointed by the Board of Directors.</p> <p>LFV is a member of COOPANS Consortium consisting of five Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviar, Navegação Aérea de Portugal (NAV Portugal) and Luftfartsverket (LFV). Cooperation between COOPANS partners goes beyond SESAR- partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is expanded to Research & Innovation by the establishment of the COOPANS Consortium.</p> <p>Luftfartsverket (LFV) has many years of experience, both in the delivery of Air Traffic Services; design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>LFV has an extensive experience and a close interaction with the industry and Swedish Transport Agency, developing new technology. The effect of this is a flexible product portfolio of functional and cost efficient solutions, like the development of Remote Tower Services (RTS) that went from idea to reality in record time.</p> <p>The enterprise is certified ISO 9001.</p>	
Previous experience	<p>LFV has participated, contributing to and also been leading projects in SESAR 1 within NORACON Consortium in the following WPs:</p> <ul style="list-style-type: none"> - WP00 - SESAR2020 preparation: 00.14, 00.15 - WP3 - Validation infrastructure adaptation and integration: 03.01.01, 03.02.01, 03.02.02, 03.03.02, 03.03.03 - WP4 - En-route Operations: 04.08.04, 04.10 - WP5 - TMA Operations: 05.03.00, 05.06.01 (Lead), 05.06.02, 05.06.04, 05.06.07, 05.07.02, 05.09 	

- WP6 - Airport Operations: 06.06.02, 06.07.01, 06.08.01, 06.08.02, 06.08.04, 06.08.08, 06.09.03(Lead)
- WP7 - Network Operations: 07.05.02, 07.05.03, 07.05.04
- WP8 - Information Management: 08.00 (Lead), 08.01.03, 08.01.04, 08.01.05, 08.01.06, 08.01.09, 08.03.00, 08.03.03, 08.03.04, 08.03.06, 08.03.10
- WP9 - Aircraft Systems : 09.48
- WP10 - En-Route & Approach ATM Systems: 10.02.01, 10.02.03, 10.03.01, 10.03.08, 10.04.04, 10.07.01, 10.09.04, 10.10.03
- WP12 - Airport Systems : 12.02.01, 12.04.06, 12.04.07, 12.04.08, 12.04.10
- WP14 - SWIM Technical Architecture: 14.01.03, 14.04
- WP15 - Non-Avionic CNS System: 15.01.06, 15.01.07, 15.02.04, 15.04.05.a, 15.04.05.b
- WP16 - R&D Transversal Areas: 16.01.02, 16.04.01, 16.04.03, 16.04.04, 16.05.04, 16.06.01.b
- WP B - Target Concept and Architecture Maintenance: B.04.01, B.04.02, B.04.03, B.04.05
- WP C - Master Plan Maintenance: C.02, C.03

Of special relevance to this project is WP5.6.1 Ground and Airborne Capabilities to Implement Sequence, WP5.6.4 Tactical TMA and En-route Queue Management, WP5.6.7 Integrated Sequence Building/Optimization of Queues and WP6.8.4 Coupled AMAN-DMAN.

The SWIM artefacts developed in WP 08.00 will be further explored in the concept.

Through the engagement in WP B.04.02, LFV has been leading the ConOps development.

In SESAR 2020, wave 1, LFV has contributed to and also been leading solutions via COOPANS Consortium in the following solutions:

- PJ.01-01 - Extended Arrival Management with overlapping AMAN operations and interaction with DCB
- PJ.01-03B - Use of Arrival and Departure Management Information for Traffic Optimisation in the TMA
- PJ.02-08 - Traffic optimisation on single and multiple runway airports (lead)
- PJ.02-11 - Enhanced Terminal Area for efficient curved operation
- PJ.05-02 - Remotely Provided Air Traffic Service for Multiple Aerodromes (lead)
- PJ.05-03 - Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules (lead)
- PJ.06-01 - Optimized traffic management to enable Free Routing in high and very high complexity environments
- PJ.10-01a - High Productivity Controller Team Organisation
- PJ.10-02b - Controller Automated Support Tools in En-Route Environment
- PJ.10-05 - IFR RPAS Integration
- PJ.15-09 - Data Centre Service for Virtual Centres Service
- PJ.16-03 - Virtual Centre Concept
- PJ.16-04 - Workstation, Controller productivity
- PJ.18-02 - Integration of trajectory management processes
- PJ.19-CI01 - ATM operations
- PJ.19-CI02 - Systems and services

	<ul style="list-style-type: none"> - PJ.19-CI04 - Support and Evolution of the Content Integration Framework - PJ20 - Masterplan maintenance - PJ.25 - E-AMAN VLD - PJ.27 - Flight Object Interoperability VLD - PJ.31 - Initial Trajectory Information Sharing VLD <p>From SESAR 2020, wave 1, it is of special relevance to this project, LFV's engagement in solution PJ.01-01 - Extended Arrival Management with overlapping AMAN operations and interaction with DCB, where LFV was responsible for and validated thread 3.</p> <p>LFV has many years of experience with arrival/departure management through the adaptation, implementation and operation of the Maestro arrival manager, which is now an integrated part of the ATM-system.</p>
Entity Profile matching the task	<p>An AoR with many airports and with several major airports close to each other and close to AoR boundaries has given LFV extensive experience in optimization of arrival and departure management.</p> <p>Expertise is present in the company in many areas:</p> <ul style="list-style-type: none"> • Remote airport ATC • Development and supervision of operational concepts • Safety concepts & Safety Assessments • Airport safety support tools • Collaborative Decision Making • Air traffic forecast/Capacity planning incl. runway capacity enhancement • CWP design • Development and implementation of ATM systems & Tools (common development and implementation of TopSky) • Trajectory management (core functionality in TopSky) • Development and implementation of safety and monitoring tools (core functionality in TopSky – 4D MTCD) • Flight procedures, special approach procedures (incl. RNAV) • Performance Based Navigation • Integration, validation and analysis of test result • Extended lab environment including NARSIM • Participation in European deployment activities (IDSG) <p>Human performance assessment</p>
Contribution	<p>LFV will contribute to operational concept development and also plan to host validation on COOPANS validation platform, NARSIM, by means of its workforce containing operational experts (ATCOs), validation experts and platform development experts</p>

4.1.1.11 Naviair

Organisation	26 Naviair /COOPANS	Service Provider
Description	<p>Naviair is a 100% state owned company originating in “Statens Luftfartsvæsen” founded in 1938. Headquarter is located in Copenhagen (TWR/APP/En-route) and subdivisions are located in Roskilde, Billund, Århus, Rønne and Ålborg (TWR/APP) and in Vagar & Nuuk (FIS/FIC).</p> <p>Naviair has three main divisions - Operations, Technical Maintenance and ATM Projects & Engineering supported by Corporate Services.</p>	

	<p>Naviar is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Luftfartsverket (LFV) and Naviar. Cooperation between COOPANS partners goes beyond SESAR – partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform.</p> <p>The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research & Innovation by the establishment of the COOPANS Consortium.</p> <p>Naviar has many years of experience, both in the delivery of Air Traffic Services; design of concepts and in development, validation and implementation of Air Traffic Management tools. The company is certified ISO 9001.</p>
Previous experience	<p>SESAR 1 experience: Naviar has participated in SESAR via NORACON consortium in the following WPs:</p> <ul style="list-style-type: none"> • WP00 SESAR2020 preparation 00.14, 00.15 • WP3 Validation infrastructure adaptation and integration: 3.2.1, 3.2.2, 3.3.2, 3.3.3 WP5 TMA Operations: 5.3, 5.6.1, 5.6.4, 5.6.7, 5.9 • WP6 Airport Operations: 6.8.4 • WP7 Network Operations: 7.5.4 • WP 8 Information Management: 08.1.3, 8.1.5, 8.1.9, 8.3.4, 8.3.10 • WP 10 En-Route & Approach ATM Systems: 10.2.1, 10.2.3, 10.3.1, 10.3.8, 10.9.4, 10.10.3 • WP 14 SWIM Technical Architecture: 14.1.3, 14.4 • WP 16 R&D Transversal Areas: 16.2.3, 16.6.2 • WP B Target Concept and Architecture Maintenance: B4.2, B4.3, B4.5 • WP C Master Plan Maintenance: C2 & C3 • SESAR 2020 experience: Naviar as participated and contributed in several projects during Wave 1 • PJ.01-01 E-AMAN - Extended Arrival Management with overlapping AMAN operations and interaction with DCB • PJ.06-01 Free Route - Optimized traffic management to enable Free Routing in high and very high complexity environments • PJ.10-02A Separation Management - Improved Performance in the Provision of Separation • PJ.10-02B Separation Management - Advanced Separation Management • PJ.14-02-02 Future Satellite Communications Data Link • PJ.14-04-01 Surveillance Performance Monitoring (Task 1) • PJ.14-04-03 New use and evolution of Cooperative and Non-Cooperative Surveillance (Task 3) • PJ.15-9 Common Services, Virtual Centre data centre service • PJ.16-3 CWP Controller productivity - Workstation, Service Interface Definition & Virtual Centre Concept • PJ.16-4 CWP Virtual Centre concept - Solution Workstation, Controller Productivity (Advanced Speech Recognition) • PJ.18-2 Trajectory Management Process • PJ.18-6 Performance Based Trajectory Prediction • PJ.19 CI1/WP2 ATM Operations (SESAR CONOPS) • PJ.20 Master Plan Maintenance

	<ul style="list-style-type: none"> • PJ.25 E-AMAN VLD • PJ.27 Flight Object Interoperability VLD • PJ.31 Initial Trajectory Information Sharing VLD
Entity matching the task	No third parties involved, Naviar will not initially participate directly in this action
Contribution	Support to participating COOPANS members if required

4.1.1.12 DASSAULT AVIATION

Organisation	5 DASSAULT	Airborne Industry
Description	<p>With more than 8000 military and civil aircraft delivered to 83 countries over the past 60 years and having logged nearly 28 million flight hours to date, Dassault Aviation is a major player in the Aeronautics field.</p> <p>On the one hand, more than 2,200 Falcons are today in operation worldwide, for the benefit of companies, major economic magnates and governments; they cover from 3350nm (Falcon 2000 S) up to 6450nm (Falcon 8X can connect Paris to Singapore).</p> <p>On the other hand, over 1000 combat aircraft produced by Dassault Aviation, ranging from the Mirage III to the Rafale, are currently in service in nearly thirty countries.</p> <p>Dassault Aviation is also fully involved in UAV/UCAV programs as:</p> <ul style="list-style-type: none"> • Designer of nEUROn combat drone, a European UCAV technology demonstrator program, which successfully completed its maiden flight on December, 1st 2012 and has completed its demonstration program; • Teaming with Airbus and Leonardo on a design study for the development of a European Male drone for Medium Altitude long-range surveillance missions. <p>The Research and Development employs nearly one quarter of the 9000 people company's workforce. Fundamental and pre-competitive research is usually carried out in close co-operation with universities, research institutes and other industrial partners via a wide international network.</p> <p>Dassault Aviation is part of ACARE and is a founding member of the JU Clean Sky and member of its Governing Board. Within European framework research programs, Dassault Aviation has led numerous PCRD projects.</p> <p>Within National context, Dassault Aviation is member of CORAC (Council for Civil Aeronautics Research), created in July 2008 following commitments made in late 2007 during the Grenelle Environment Forum and is member of the Steering Committee.</p>	
Previous experience	<p>Dassault Aviation has a long experience on the user side of ATM, designing, integrating and certificating avionics systems to allow safe and efficient operations and traffic insertion (within their respective requirements) of civil aircraft, military aircraft, and even UAVs.</p> <p>Dassault Aviation has also developed a good knowledge of many ATM stakeholders, mainly through the participation in standardisation working groups (EUROCAE...), standards harmonisation of operations working</p>	

	<p>groups, implementation of regulatory guidance and procedures that will support the introduction of new concepts and in the validation of safety compliance of the systems.</p> <p><u>Previous experience related to solution 17:</u></p> <ul style="list-style-type: none"> • Dassault Aviation has been the first to receive CAT III operational qualification on the Falcon 900EX equipped with Head-Up Guidance System and is also pioneer in innovation on flight controls (Fly by wire systems). • HUD/EFVS FALCONEYE (Dassault product proposed on Falcons 8X/2000/900) : First Head-Up display to certify combine Vision System (SVS and EFVS image) : <ul style="list-style-type: none"> ○ Certified in 2016 for situational awareness ○ Certified in 2018 with EFVS ops credit down to 100 ft. ○ Certification planned in 2020 with EFVS to LAND Ops Credit • In SESAR, Dassault Aviation participates to EFVS to land operations in low visibility conditions projects (SESAR 1 open call AAL project, and SESAR 2020 wave 1 VLD AAL2 project), and also to PJ03a-4 Enhanced visual operations. <p><u>Previous experience related to solution 25:</u></p> <ul style="list-style-type: none"> • Dassault Aviation participated to the Flight Test Harmonization Working Group (FTHWG) that was tasked by the FAA to look at issues that have arisen concerning degradation of friction on a wet runway. In the frame of this working group, Dassault Aviation participated to the analysis of several accidents and incidents supported by aircraft data or demonstrations to validate a new reference for aircraft braking performance on standard Wet runway. • In wave 1 Dassault Aviation made flights tests with an automatic Runway Overrun Awareness and Alerting System proof of concept for Business Aviation and highlighted associated benefits. <p>In SESAR 2020 wave 1 IR projects , Dassault Aviation contributes to some projects in order to highlight Business Aviation needs and specificities and pave the way for the deployment of beneficial solutions; in particular, in PJ01, PJ03a, PJ03b, PJ10, PJ11, PJ18 and PJ19/PJ20 (Concept of Operation and MASTERPLAN).</p>
<p>Entity Profile matching the task</p>	<p>Within this project, Dassault Aviation will contribute to both solutions 17 and 25.</p> <p>Technical Directorate and Flight Test Directorate will contribute to the project. In those Directorates, expertise will mainly be,</p> <ul style="list-style-type: none"> • Avionics and systems Department (Hud/Efvs and Vision Systems expert, radar expert) • Aircraft engineering Directorate (Aircraft performance) • Flight test and operational pilots
<p>Contribution:</p>	<p>Dassault Aviation will contribute to the project by:</p>

- Bringing expertise and knowledge in the field of business aircraft operational and technical needs, performance assessment, standardisation/regulation updates recommendations and CBA
- Participating to operational concept definition
- Participating to proof of concept validation
- Conduction of validation exercises, analysis of results and preparation of validation report.
- In solution 17, Dassault will work and mature advanced CVS (Combined Vision System) systems and operations to further improve business aircraft operations. Dassault Aviation will use Development Flight Simulator to perform some evaluations and will use also sensors simulations tools during low visibility approaches.
- In Sol 25, Dassault will work on a set of embedded tools for avoiding runway excursions (Sol 25). Dassault Aviation will provide a flight test aircraft for operational evaluation on partner airports.

Main part of the work will be to evaluate how runway condition awareness improvement can benefit to global safety and more particularly to the safety of business aircraft operations and environment (especially regional and local aerodromes).

Within this project, Dassault Aviation will contribute to both solutions 17 and 25

Technical Directorate and Flight Test Directorate will contribute to the project. In those

Directorates, expertise will mainly be,

- Avionics and systems Department (Hud/Efvs and Vision Systems expert, radar expert)
- Aircraft engineering Directorate (Aircraft performance)
- Flight test and operational pilots

4.1.1.13 DFS DEUTSCHE FLUGSICHERUNG GMBH

Organisation	6 DFS	Service Provider
Description	<p>DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS) is responsible for air traffic control in Germany and is headquartered in the town of Langen, near Frankfurt. It is a company organised under private law and is wholly owned by the Federal Republic of Germany.</p> <p>The main business of air navigation services provided by DFS is defined by the tasks set out in Section 27c of the German Aviation Act (LuftVG). DFS provides air traffic services as a sovereign function, coordinates the air traffic flow and manages airspace utilisation (as a company entrusted with State functions). For this purpose, it develops and operates air traffic service systems as well as communications, surveillance and navigation systems. DFS operates control centres in Langen, Bremen, Karlsruhe and Munich as well as 16 control towers at Germany's designated international airports. With its approximately 5,400 operational and administrative staff, DFS ensures that approximately three million flights under instrument flight rules (IFR) reach their destinations safely and on time each year.</p>	

	DFS has experience in the complete cycle of ATM solution development, including operational requirements specification, in-house software development, and validation in the DFS simulator facilities. Close cooperation of operational and technical staff allows fitting the solutions to the exact needs of the DFS ATCOs.
Previous experience	<p>Previous projects:</p> <ol style="list-style-type: none"> 1. LUFO IV, 2. call, Projekt iPort Rollführung, AP 3.8: Airport Situation Assessment Server (ASAS), 2009 – 2012 2. SESAR 1: besides many other projects DFS contributed in the following Airport Safety Net related projects: <ul style="list-style-type: none"> - 06.07.01 Airport Safety Support Tools for Pilots, Vehicle Drivers and Controllers - 12.03.02 Enhanced Surface Safety Nets 3. SESAR 2020 Wave 1: DFS contributed to Routing, Guidance and Airport Safety Tools in the solutions PJ03a-01 and PJ03b-01. <p>Publications:</p> <ul style="list-style-type: none"> • Benjamin Weiß, Federico Centarti, Felix Schmitt, Stephen Straub (2013): Route-Based Detection of Conflicting ATC Clearances on Airports. In: ESAVS 2013, DGON-Symposium "Enhanced Solutions for Aircraft and Vehicle Surveillance Applications" 2013, abstract: https://arxiv.org/abs/1304.6494 • Felix Schmitt, Ralf Heidger, Stephen Straub, Benjamin Weiß (2013): Software Design Principles of a DFS Tower A-CWP Prototype. In: ESAVS 2013, DGON-Symposium "Enhanced Solutions for Aircraft and Vehicle Surveillance Applications" 2013, abstract: https://arxiv.org/abs/1304.6505 • Marcus Biella, Karsten Straube, Marcus Helms, Stephen Straub, Benjamin Weiß, Felix Schmitt, Heribert Lafferton, Stéphane Dubuisson, and Roger Lane (2013): How Can a Future Safety Net Successfully Detect Conflicting ATC Clearances – Yet Remain Inconspicuous to the Tower Runway Controller? First Results from a SESAR Exercise at Hamburg Airport. In: 10th International Conference on Engineering Psychology and Cognitive Ergonomics: Applications and Services (EPCE), 2013,, abstract: https://link.springer.com/chapter/10.1007/978-3-642-39354-9_8 • Mohamed Ellejmi, Benjamin Weiß, Felix Schmitt, Stephen Straub (2015): Integration of a Routing Tool in an Advanced Airport Controller Working Position. In: 15th AIAA Aviation Technology, Integration, and Operations Conference AIAA Aviation, abstract: https://arc.aiaa.org/doi/10.2514/6.2015-2595
Entity Profile matching the task	<p>Airport safety nets developed by the DFS System House are in operation at Hannover, Munich, and in test at Düsseldorf and Köln-Bonn Airport. Significant research for this development was performed in the national iPort project (see section “Previous experience”, project 1.).</p> <p>DFS has extensive expertise in the specification of operational procedures, in research and development of ATM systems, and in operational validation. Within SESAR 1 (WP 6 and WP 12), DFS has developed a comprehensive enhanced airport safety nets prototype for Conflicting ATC Clearances (CATC) and Conformance Monitoring Alerts for Controllers (CMAC), based on its</p>

	<p>operational systems. DFS has led validation exercise EXE-06.07.01-VP-438 on CATC in 2012. It has contributed to validation exercise EXE-06.09.02-VP-678 in 2014 and led validation exercise EXE-06.09.02-VP-679 in 2015, both of which addressed (among other objectives) the CATC and CMAC safety net functions. In SESAR 2020 Wave 1, DFS contributed to Routing, Guidance and Airport Safety Support Tools in the solutions PJ03a-01 and PJ03b-01. DFS successfully executed RTS trials addressing Guidance through AGL and CATC/CMAC safety net functions.</p> <p>DFS has extensive experience with platforms and validations. For the SESAR 1 and SESAR 2020 Wave 1 validation exercises, the DFS prototype has been integrated into the Airport Research Facility Hamburg IBP, into the EUROCONTROL eDEP IBP (Brétigny), and into the DFS TOWER IBP (Langen).</p> <p>For the V3 validation exercise DFS will provide the validation platform at Düsseldorf Tower, including the DFS Surface Manager (SMAN) which is hosting the Safety Tools prototype.</p> <p>Düsseldorf Airport is one of the airports for deployment of the PCP (IR 716/2014) solutions. It provides the surveillance sensor infrastructure required to execute the validation exercise.</p>
Contribution	<p>DFS will contribute to solution PJ.02-21, providing operational, validation, standardisation and technical expertise as well as validation platform infrastructure. DFS will actively engage in prototype development activities and will lead a V3 validation exercise. The V3 exercise will be executed as shadow mode live trials at Düsseldorf Airport.</p> <p>DFS will provide the following experts to perform the validation exercise:</p> <ul style="list-style-type: none"> • Air Traffic Controllers • Software engineers • ATM operational specialists • Validation experts • Human factors experts

4.1.1.14 ENTIDAD PUBLICA EMPRESARIAL ENAIRE

Organisation	7 ENAIRE	Service Provider
Description	<p>The Spanish Business Public Entity “Entidad Pública Empresarial ENAIRE”, hereinafter referred to as “ENAIRE”, is the entity designated by the Spanish State to provide Air Navigation Services for En-Route and Approach phases, ruling 7 En-route/TMA ATC Centres and 22 Control Towers, being one of the major Air Navigation Service Providers in Europe.</p> <p>Airspace under ENAIRE control includes the Peninsula Ibérica (except Portugal), Balearic and Canary Island, and part of North Atlantic, West Mediterranean and West Sahara.</p> <p>ENAIRE is a major European company in ATM, R&D and project management in the field of Airspace and Air Navigation and a founding member of the A6 alliance, which represents the ANSPs common view within SESAR Programme.</p>	

	<p>ENAIRE has already been an active part of SESAR Programme from the very beginning and has substantially contributed as a SJU member in the different fields of airport and air navigation services management, planning and provision, and other ATM R&D related activities, in order to support the cooperative accomplishment of the European ATM Target Network and the associated European ATM Master Plan. As a quantitative illustration of this commitment, the more than ninety SESAR projects in which ENAIRE has been involved up to the present could be mentioned, playing a leading role in sixteen of them.</p> <p>As a services provider and also as owner of related systems and infrastructure, proactive promoter of research and development activities which are at the leading edge and highly experienced executor of validation and system integration processes, ENAIRE expects to maintain its participation in the SJU as one of its major members in those areas of activity where its technical and managerial expertise and know-how, systems and projects can bring the most added value to the deployment of the European ATM Master Plan.</p> <p>The added value provided to SESAR 2020 by ENAIRE and its linked third parties is based in the large set of available assets:</p> <ul style="list-style-type: none"> • Up to 7 En-route/TMA ATC centres, covering both Continental and Oceanic Airspaces, fitted with an advanced and evolving ATM system (SACTA/LIS ATM and in the future iTEC). Four of them, those covering the Continental Spanish Airspace, interconnected and working as a network; • Platforms are able to assume validations and simulations in a wide range of maturity levels, covering from the more immature phases of the R&D till complex simulations using both industrial products and also prototypes; • ATCOs from different ACC's, who are familiar with traffics, contingencies and events of multiple characteristics; and also from towers of different categories; • Engineers/ATCOs with vast expertise on the definition of future CNS and ATM; <p>Paving the way for deployment of mature concepts, especially those included in the PCP, will constitute a paramount and permanent priority for ENAIRE.</p>
Previous experience	<p>ENAIRE is the company designated by the Spanish State to provide air traffic services in the en-route and approach phases. As part of an extensive ANSP work, ENAIRE manages the air traffic control and aeronautical information services, as well as the communication, navigation and surveillance networks required so that airlines and their fleet can fly safely and smoothly throughout the Spanish airspace. In addition, ENAIRE has defined several requirements in order to develop and improve the trajectory management within and among different ACCs. ENAIRE also participates in the definition and specification of the iTEC flight plan processing systems, besides the definition of its interoperability requirements to be compatible with other service provider initiatives.</p> <p>ENAIRE is the leading air navigation and aeronautical information service provider in Spain, the fourth largest in Europe by traffic volume and one of the most important in the world. As a public business entity reporting to the Ministry of Public Works, we manage the Spanish airspace over a territory of 2.19 MN square kilometres. ENAIRE provides air traffic services to 2 million flights carrying over 250 million passengers each year. Through our five control centres, 21 control towers and a comprehensive network of aeronautical infrastructure and equipment, we provide en-route, approach and aerodrome</p>

ATC services, as well as flight information, alerts and consulting services. We are the communications, navigation and surveillance service provider across the whole of the Spanish airspace and at airports in Aena network.

This activity as Service Provider has been combined with several research and deployment projects. Actually, ENAIRE has been an active part of the SESAR from the very beginning of the Programme, contributing substantially as a SJU member in different fields (airports, ANS management, ANS planning and provision, etc.). This has been done in order to support the cooperative accomplishment of the European ATM Target Network and the associated European ATM Master Plan. The participation within the SESAR Programme began with SESAR 1, where ENARE took an active role in several projects, being the project leader in some of them. After the work performed in SESAR 1, ENAIRE has contributed in the great majority of the projects launched in SESAR 2020 Wave 1 programme, being an important part of the Service Providers Stakeholder group.

Participation in SESAR 1 projects:

- WP3 – Validation infrastructure adaptation and management
- WP4 – En route Operations
- WP5 - TMA Operations
- WP6 – Airport Operations (taking the leadership of the work package)
- WP7 – Network Operations
- WP8 – Information Management
- WP10 – En-Route & Approach ATC Systems
- WP12 – Airport system
- WP13 – Network Information Management System
- WP15 – Non-Avionics Communication, Navigation, Surveillance (CNS) System
- WP16 – R&D Transversal Areas
- WPB – Target Concept and Architecture Maintenance
- WPC – Master Plan Maintenance

Within these projects, ENAIRE has participated in the operational concept development and has been also responsible for the execution of several validations.

Participation in SESAR 2020 Wave 1:

- PJ01: Enhanced Arrivals and Departures
- PJ02: Increased Runway and Airport Throughput
- PJ03a: Integrated Surface Management
- PJ04: Total Airport Management
- PJ06: Trajectory based Free Routing
- PJ07: Optimised Airspace Users Operations
- PJ08: Advanced Airspace Management
- PJ09: Advanced DCB
- PJ10: Controller Tools and Team Organisation for the Provision of Separation in Air Traffic Management
- PJ11: Enhanced Air and Ground Safety Nets
- PJ14: Essential and Efficient Communication Navigation and Surveillance Integrated System
- PJ15: Common Services

- PJ16: Controller Working Position / Human Machine Interface - CWP/HMI
- PJ17: SWIM Technical Infrastructure
- PJ18: 4D Trajectory Management
- PJ19: Content Integration
- PJ20: Master Plan Maintenance
- PJ24: Network Collaborative Management
- PJ27: Flight Object Interoperability VLD Demonstration

Other projects managed by the SESAR Joint Undertaking:

- DEMORPAS (Demonstration Activities for Integration of RPAS in SESAR), playing ENAIRE a leading role.
- ARIADNA (Activities on RPAS Integration Assistance and Demonstration for operations in Non-segregated Airspace).

Previous participation in EC projects:

- OPTIMAL – Optimized Procedures and Techniques for IMprovement of Approach and Landing
- RESET – Reduced separation minima
- GIANT – GNSS Introduction In the Aviation sector & GIANT 2 – GNSS Introduction In the Aviation sector -2
- ACCEPTA – ACCelerating EGNOS adoPTion in Aviation
- FilGAPP – Filling the Gap in GNSS Advanced Procedures and Operations
- HEDGE Next – Helicopter Deploy GNSS in Europe – NEXT
- CREDOS – Crosswind Reduced Separations for Departure Operations

Additionally, ENAIRE and its linked third parties has contributed to several Framework Programme (FP) projects such as:

- EPISODE 3, Single European Sky Implementation support through validation, FP6, 2004-2010, Key Performance Targets for the future ATM system.
- GATE TO GATE, Validation of a European ATM gate to gate operational concept for 2005 – 2010, FP5, 2002-2005, operational concept development and validation.

Regarding deployment activities, the Spanish Automated Air Traffic Control System (SACTA) has been continuously evolved. One example could be the following TENT-T project:

- FRASAI, TENT-T, 2014, Free Routing concept implementation in Santiago – Asturias sector.

In addition to these projects, ENAIRE is currently carrying out the following research projects related to RPAS:

- DOMUS
- SAFEDRONE

As well as the contribution, through any of ENAIRE's Linked Third Parties, to TERRA, IMPETUS and the advisory board of CORUS.

Entity Profile
matching the task

- Operational expert
- ATC system expert

	<ul style="list-style-type: none"> • En Route, App and Tower Air Traffic Controllers • Environment expert • Performance expert • Platform integration/maintenance
Contribution	<p>ENAIRE will contribute to solution PJ.02-14, PJ02-17 and PJ02-21. In Solution #14, ENAIRE will provide support to the concept development and procedure design tasks through development in the Runway Occupancy Time and Exit prediction model.</p> <p>In Solution #17 ENAIRE will contribute to the V3 concept description from the point of view of an ANSP. ENAIRE will also contribute to the rest of deliverables related to the solution.</p> <p>In Solution #21, ENAIRE will perform a V3 validation on A-SMGCS based Extended Airport Safety Nets and Advanced Automated Assistance for Surface Movement Planning and Routing.</p>

4.1.1.15 ENAV SPA

Organisation	8 ENAV	Service Provider
Description	<p>ENAV S.p.A. (ENAV) is one of the 5 largest European Air Navigation Service Provider in terms of traffic managed, investments in innovation technology and R&D and is one of the top performers in terms of quality of services provided.</p> <p>ENAV is fully committed to the Single European Sky and, since 2006, operates under the Common Requirement for ANS provision and from 2012 is subject to the European Performance Scheme, as all other European ANSPs.</p> <p>ENAV is a Joint-Stock Company, the only ANSP worldwide listed on a stock exchange, 53% of the share capital is held by the Italian Government, in charge of the provision of air traffic control and navigation services within the airspace and the airports placed under its own responsibility by national law without time limit.</p> <p>ENAV's core business is to manage the regulated Air Traffic Control Services (ATCS), for which it is entrusted, allowing aircraft to fly within the assigned airspace with constantly enhanced levels of safety, optimizing the effectiveness of the service provided and the efficiency of the company, in particular:</p> <ul style="list-style-type: none"> ✓ "En route" services: handling of air traffic crossing Italian airspace managed from 4 Areas Control Centres located in Rome, Milan, Padua and Brindisi; ✓ "Terminal" services: assistance during the phases of approach, take-off and landing from 45 Control Towers located throughout Italy and divided into 3 charging zones. <p>Thanks to these complex operational units, ENAV provides around the clock air traffic services ensuring air traffic flow and regularity, with absolute safety.</p> <p>ENAV provides ATCS to more than 1.8 million flights per year, with peaks of up to 6,575 per day.</p>	

ENAV provides also supporting services to other ANSP on a commercial basis, forming an independent source of revenue which is not regulated.

ENAV leverages its significant experience and reputation for promoting development projects worldwide, pursuing further opportunities for growth: currently delivers services in Malaysia, Saudi Arabia, Kenya, Morocco, Albania, UAE and Libya.

As in all high complexity sectors, a constant and consistent technological innovation has to be placed side by side to human skill and experience.

For this reason, ENAV continues to invest in modernisation, new technologies and professional training. ENAV is a component of the European ATM (Air Traffic Management) system and it participates with full rights in all the activities of development, operational validation, research and coordination with systems that are perfectly integrated with the international technological context.

ENAV Group consists of:

- Techno Sky, responsible for the operational management, the support, the maintenance and the hardware/software development of entire range of systems and equipment used to provide flight assistance services;
- IDS AIRNAV is the company of the ENAV Group that serves the world of Air Traffic Management (ATM) and airports with Commercial Off-The-Shelf (COTS) solutions and software products aimed at supporting the transition from Aeronautical Information Services (AIS) to Aeronautical Information Management (AIM) in full compliancy with the ICAO and EUROCONTROL mandates for Aeronautical Data Quality (ADQ);
- D-flight is the first public-private partnership created by ENAV and its partners for the timely development and deployment of U-space, in order to safely and seamlessly integrate complex drones operations within the civil aviation airspace. The company is controlled by ENAV, with a 60% stake, with the remainder of the share capital held by a group of leading Italian technological partners;
- ENAV Asia Pacific, set up in 2013 with head office in Kuala Lumpur, provides air traffic control management and consultancy services, as part of marketing and sales activity, as well as other essential air navigation services;
- ENAV North Atlantic is a company established in USA on January 2014 for the purpose of managing the acquisition of 12.5% of the Aireon LLC share capital. Aireon is the company responsible for the development, financing and deployment of a global satellite surveillance system;
- ESSP - with a 16.6% stake in the Company, ENAV provides the European satellite navigation service EGNOS.

The services supplied by the Company are Planning, management and provision of Air Navigation Services (ANS) including:

- Air Traffic Services (ATS), including Air Traffic Control Service (ATC), Flight Information Service (FIS) and Alerting Service (ALRS);
- Aeronautical Information Service and related publications (AIS);
- Meteorological Services for Air Navigation (MET);
- Communication, Navigation, Surveillance Services (CNS);
- Air Space Management;

	<ul style="list-style-type: none"> • Air space design and air traffic capacity planning; • Flight procedures design and obstacles analysis; • ATM system definition, acquisition, operation and maintenance of operational infrastructures; • Flight inspection services of radio nav aids, broadcasting and surveillance systems for Air Traffic Services; • Training of ATM personnel. <p>ENAV is among the main players in SESAR (Single European Sky ATM Research), the ambitious initiative launched by the European Commission to implement the Single European Sky by supporting technical developments for fully interconnected and interoperable systems at European level.</p> <p>ENAV is also member of the SESAR Joint Undertaking, created under European Community law on 27 February 2007, with EUROCONTROL and the European Union as founding members, in order to manage the SESAR Development Phase. ENAV contributes to SJU in a lot of projects providing the technical and operational expertise and infrastructures necessary to develop and validate the evolution of the operational concepts.</p>
Previous experience	<p>ENAV is involved in R&D, strategic planning, technical co-operation and service provision programs with international organisations (e.g. SESAR Joint Undertaking, EUROCONTROL, European Commission, ESSP) and foreign countries, aiming at contributing to the advancement of ATM technology and processes and at improving the service level provided.</p> <p>ENAV has a long-lasting experience in international initiatives and has been participating, managing, coordinating and actively contributing to several international projects and large scale researches, developments and validations.</p> <p>ENAV has been participating in SESAR Programme since its very beginning (SESAR 1 and SESAR 2020 Wave 1) and is strongly determined to support the successful outcome of the initiative in line with its strategic objectives.</p> <p>Previous R&D projects:</p> <ul style="list-style-type: none"> • SESAR 1 (2009-2016): WPB, WPC, WP3, WP4, WP5, WP6, WP7, WP8, WP10, WP12, WP13, WP14, WP15, WP16 • SESAR 1 Large Scale Demonstrations: <ul style="list-style-type: none"> ○ ATC Full Datalink (AFD) ○ WE-FREE ○ MEDALE ○ RACoon ○ FREE SOLUTIONS • BEYOND (H2020, 2015-2017) • DARWIN (H2020, 2015-2018) • SAWSOC (FP7, 2013-2016) • GAMMA (FP7, 2013-2017) • FUTURE SKY SAFETY (H2020, 2015-2019) • OPTIMAL (FP6, 2004-2008) • AD4 (FP6, 2005-2007) • RETINA (H2020, 2016-2018) • BLUEGNSS (H2020, 2016-2018)

	<p>Current R&D projects:</p> <ul style="list-style-type: none"> • SESAR 2020 Wave 1 IR Projects (H2020, 2016-2019): PJ01, PJ02, PJ03a, PJ03b, PJ05, PJ06, PJ08, PJ09, PJ10, PJ15, PJ16, PJ18, PJ19, PJ20, PJ22 • SESAR2020 Wave 1 VLD PJ31 (H2020, 2016-2020) • DIODE VLD (SJU/CEF2017, 2018-2020) • CORUS ER (H2020, 2017-2019)
Entity matching the task	<p>Profile</p> <p>ENAV profiles matching the tasks include:</p> <ul style="list-style-type: none"> • ATM Operational expert and engineer • Air Traffic Controller • Pseudo-pilot • KPA expert • Project manager • Validation expert and engineer <p>All those skills will be made available by ENAV to support the project developments and conduct validation activities.</p>
Contribution	<p>ENAV participation in the project is devoted to Solution PJ.02-W2-21 “Digital evolution of integrated surface management” (WP06).</p> <p>In continuation with the work done and the leading role Enav had in PJ03a of Wave 1, ENAV is proposed to lead WP06 and contribute to the solution developments.</p> <p>ENAV will monitor and coordinate the WP0 work and will support, with its operational and technical expertise, the solution developments by actively contributing to the operational data pack elaboration.</p> <p>ENAV is also proposing to contribute with a validation exercise on surface operations management with focus on Dynamic Virtual Block Control.</p>

4.1.1.16 ATOS BELGIUM

Organisation	27 ATOS (FSP)	Ground Industry
Description	<p>Atos Belgium is a company within Atos SE (Societas Europaea) group. Atos is a leader in digital services with 2014 pro forma annual revenue of €10 billion and 86,000 employees in 66 countries. Serving a global client base, the Group provides Consulting & Systems Integration services, Managed Services, Cloud operations, Big Data & Security solutions, as well as transactional services. Throughout Europe, more than 300 Atos ATM experts provide solutions and architecture support to Air Navigation Service Providers, Airports, Airlines and EUROCONTROL Network Manager.</p> <p>Atos Belgium is member of the Frequentis SESAR Partners consortium together with the companies HUNGAROCNTRM MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG and Frequentis AG which was founded in 2014 for the main purpose of joining SESAR2020 activities. Frequentis SESAR Partners is member of the SESAR Joint Undertaking.</p> <p>The consortium is comprised of companies having a variety of complementary capabilities. Having former SESAR1 experience within its framework, an</p>	

	ANSP whose expertise will result in early feedback loops during certain projects, and the wide range IT, data management and security expertise of the consortium forming entities, Frequentis SESAR Partners believes in the high added value of its participation in SESAR2020 efforts.
Previous experience	Atos (FSP) is participating in PJ04, PJ07, PJ08 and PJ09 in SESAR 2020 wave 1 implementation.
Entity Profile matching the task	Not applicable, ATOS (FSP) initially will not participate actively in this action.
Contribution	Support to participating members of Frequentis SESAR Partners if required.

4.1.1.17 *FREQUENTIS AG*

Organisation	28 <i>FRQ (FSP)</i>	Service Provider
Description	<p>Frequentis AG, member of SESAR1 and SESAR 2020, is an international expert for communication and information systems for control centres with safety-critical tasks. Frequentis AG maintains a worldwide network of subsidiaries and local representatives in more than 50 countries to ensure closeness to our customers.</p> <p>Frequentis AG successfully designs and supplies systems and solutions for the domains of communication, networks, SWIM, aeronautical information management, and airport traffic optimization, both in service and infrastructure as well as in the visualisation part of the independent CWP; based on service oriented and open, standardised architecture. In SESAR1 and S2020 Wave 1 we successfully demonstrated remarkable achievements towards the next generation ATM system architecture.</p> <p>Special interest is given to the users of ATM systems. Our expertise and tooling guarantees early indications of the future user acceptance.</p> <p>Frequentis AG is member of the Frequentis SESAR Partners consortium together with the companies HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG and Atos Belgium, founded in 2014 for the main purpose of joining SESAR 2020 activities. Frequentis SESAR Partners is member of the SESAR Joint Undertaking.</p> <p>The consortium is comprised of companies having a variety of complementary capabilities. Having former SESAR experience within its framework, an ANSP whose expertise will result in early feedback loops during certain projects, and the wide range IT, data management and security expertise of the consortium forming entities, Frequentis SESAR Partners believes in the high added value of its participation in SESAR 2020 efforts.</p>	
Previous experience	Frequentis actively contributes within S2020 wave 1 in PJ03A, PJ03B, PJ05, PJ10, PJ14, PJ15, PJ16, PJ17, PJ18 and PJ19. In SESAR 1 we were involved in 41 different projects.	
Entity Profile matching the task	Not applicable, FREQUENTIS (FSP) initially will not participate actively in this action.	
Contribution	Support to participating members of Frequentis SESAR Partners if required.	

4.1.1.18 *HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN*

Organisation	9 <i>HC (FSP)</i>	Service Provider
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Description	<p>HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG is a state-owned company in Hungary, which provides air navigation services in the Hungarian airspace and (on a NATO assignment) in the upper airspace over Kosovo, trains air control personnel and conducts air navigation research and development.</p> <p>Hungarocontrol Zrt. is member of the Frequentis SESAR Partners consortium together with the companies Atos Belgium SA/NV and Frequentis AG and was founded in 2014 for the main purpose of joining SESAR2020 activities.</p> <p>Frequentis SESAR Partners is member of the SESAR Joint Undertaking. The consortium is comprised of companies having a variety of complementary capabilities. Having former SESAR1 experience within its framework, an ANSP whose expertise will result in early feedback loops during certain projects, and the wide range IT, data management and security expertise of the consortium forming entities, Frequentis SESAR Partners believes in the high added value of its participation in SESAR2020 efforts.</p>
Previous experience	<p>Hungarocontrol Zrt. has more than 50 years of experience in ATM and it has implemented several technical and operational updates for the entire Hungarian airspace. Since its foundation, it has a very strong relation with universities and scientific centres.</p> <p>HungaroControl Zrt. has participated in SESAR 2020 Wave 1 as a member of FSP Consortium in the following projects, solutions or VLDs:</p> <ul style="list-style-type: none"> • PJ.03-A • PJ.05-02 • PJ.05-03 • PJ.10-01B • PJ.16-03 • PJ.16-04 • PJ.28 (as a linked third-party) • SESAR Exploratory research - USIS project
Entity Profile matching the task	<p>HungaroControl Zrt. has participated in PJ.03-A SUMO - Integrated Surface Management project in SESAR 2020 Wave 1, which aimed to identify and validate operational and technological solutions aiming at enhancing airport operations.</p> <p>HungaroControl Zrt. has contributed in Work Package 1 - Enhanced Guidance Assistance to Aircraft on the Airport Surface Combined with Routing, which included working on the PMP, OSED, VALP, VALR, Availability Note, and a Validation Exercise in partnership with Frequentis AG, COOPANS members, EUROCONTROL and NATMIG members. The V2 simulation took place in Bretigny in April 2018, with ATCO contribution from HungaroControl side.</p> <p>HungaroControl Zrt. as an ANSP provided:</p> <ul style="list-style-type: none"> • ATM Operational expertise, • ATM System expertise, • Simulation expertise (Simulation HUB)

	<ul style="list-style-type: none"> • En-Route and Approach Air Traffic Controllers, • Human Factors expertise, • Safety expertise
Contribution	<p>HungaroControl Zrt. (as member of FSP) will contribute to the solution related to Digital evolution of integrated surface management in the frame of PJ02, Solution 21.</p> <p>The objective is to conduct V3 validation of supplementary guidance provided to pilots and vehicle drivers. Focus is to increase pilots' and vehicle drivers' situational awareness in all weather conditions.</p> <p>HungaroControl Zrt. will participate in PJ.02-21 Exercise 5 – Safe guidance for pilots and vehicle drivers (V3), in partnership with Indra Navia (INDRA).</p> <p>The main contribution of HungaroControl Zrt., as ANSP, will be to provide:</p> <ul style="list-style-type: none"> • Validation Environment • Support with ATCOs • ATM system experts • Airspace Design Specialists • Human Factor expertise • Safety experts

4.1.1.19 HONEYWELL AEROSPACE

Organisation	10 HONEYWELL	Airborne Industry
Description	<p>Honeywell Aerospace provides integrated avionics, engines, electrical and mechanical systems, and service solutions to aircraft manufacturers, airlines, military, and space and airport operations. It serves aerospace customers all over the world and provides products for any type of aircraft (from small and unmanned, over business jets and regional aircraft, to large long range aircraft like the Airbus 380). Worldwide, Honeywell is investing heavily in ATM (Air Traffic Management) related developments, notably through participation in the European SESAR programme and the US NextGen programme. Also, Honeywell has established an ATM laboratory in China in partnership with China's Avic. These activities add value to our SESAR work by ensuring global harmonization and a global impact of SESAR solutions.</p> <p>In this Project we will contribute via the Honeywell Aerospace SAS site located in Toulouse (France), together with its Linked Third Parties Honeywell International, s.r.o., with sites in Prague and Brno (Czech Republic). These facilities are equipped with state of the art research and test laboratories enabling research, development, integration, verification and validation of various aircraft systems. Honeywell possesses also its own fleet of test aircraft, which will support the project wherever needed, as they did ever since Honeywell became a Member of the SJU (SESAR Joint Undertaking) in 2007.</p>	
Previous experience	<p>The innovation proposed in this proposal will rely on the extensive research and product development experience gained through the development of Honeywell product families. Honeywell is a well-established avionics</p>	

	<p>manufacturer (GNSS receivers, GBAS air and ground equipment, FMS, displays, etc.) with strong expertise in navigation, sensors and human factors for air transport, regional and business jet platforms.</p> <p>Honeywell participated in several research and development projects relevant for the proposed work under PJ.02-W2-17, including:</p> <ul style="list-style-type: none"> • SESAR 9.29 (AdvCVS – Advanced Combined Vision System, concept definition, validation) – Honeywell is the Project Manager, focusing on Enhanced Vision Systems (EVS), Synthetic Vision Systems (SVS) and their combination (CVS). • Honeywell lead ESA projects, such as User Autonomous Integrity Monitoring or EGNOS v3 Demonstrator (future SBAS) and national project with Technology Agency of the Czech Republic named RESPOL (Position, Attitude & Heading Reference System). • SESAR 9.27 (GNSS Receiver, system development and validation, hybridization INS&GNSS). • SESAR 9.12 (GBAS CAT II/III Airborne, system development, validation for business aircraft, flight tests). • SESAR 15.3.7 (MCMF GBAS System & ground). • LSD02.02 AAL (Augmented Approaches to Land) - Honeywell is a key member of Large Scale Demonstration Project, focusing also on RNP to xLS and increased glideslope benefit demonstration and flights. • SESAR 2020 PJ.02-06 (Improved Access into Secondary Airports in Low Visibility Conditions) - Honeywell is a key airborne industry member focusing on initial research of LPV 100 capability. • SESAR 2020 AAL2 (Augmented Approaches to Land 2) - Honeywell is the Project Manager, focusing on enabling CAT II approaches using CAT I GBAS equipment. • SESAR 2020 PJ.03a-04 (Enhanced Visual Operations) – Honeywell is solution leader and key member focusing on CVS (AdvCVS) supported by an active sensor. <p>Honeywell actively participates to standardization activities within ICAO NSP (Navigation Systems Panel), ICAO IFPP (Instrument Flight Procedures Panel) and RTCA (SC-159/WG4 - GBAS), EUROCAE WG28 (Ground Based Augmentation Systems GBAS) and EUROCAE WG79/RTCA SC213 (Enhanced Flight Vision Systems and Synthetic Vision Systems (EFVS/SVS)).</p>
<p>Entity matching the task</p> <p>Profile</p>	<p>Honeywell infrastructure and equipment relevant for the proposed work:</p> <ul style="list-style-type: none"> • Simulation platforms and tools • Human Factor Lab cockpit simulator • Experimental aircrafts equipped with testing benches • GNSS receiver prototypes <p>Infrastructure contains engineers and specialists for the proposed work:</p> <ul style="list-style-type: none"> • Signal processing and radar engineers • Flight operation specialists • Software engineers • Human factor experts • Validation experts

Contribution	<p>Honeywell will lead solution 17 and contribute to development and validation technologies supporting the improved access to secondary airports:</p> <ul style="list-style-type: none"> • LPV-100 capability supported by SBAS providing improved approach procedure in LVC by lowering minima • Combined Vision System using active sensor providing improved resilience to LVC
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4.1.1.20 INDRA SISTEMAS SA

Organisation	11 INDRA	Ground Industry
Description	<p>Indra is one of the leading global technology and consulting companies and the technological partner for core business operations of its customers world-wide. It is a world-leader in providing proprietary solutions in specific segments in Transport and Defence markets, and the leading firm in Digital Transformation Consultancy and Information Technologies in Spain and Latin America through its affiliate Minsait. Its business model is based on a comprehensive range of proprietary products, with a high-value focus and with a high innovation component. In the 2017 financial year, Indra achieved revenue of €3.011 billion, with 40,000 employees, a local presence in 46 countries and business operations in over 140 countries.. Indra ranks second in Europe by R&D spent. .</p> <p>With the aim to provide our Customers with comprehensive, full and turnkey solutions, Indra product range covers the whole range of Air Traffic Management Systems, including Surveillance, Automation, Communications, Simulators and NAVAIDS.</p> <p>At Indra we have developed air traffic management systems that are deployed across the world, with over 4,000 installations in 160 countries. We are positioned as the market's leading supplier of air traffic management and communications, navigation and surveillance (ATM-CNS) systems. In the field of R&D, we are one of the leading companies in the SESAR program, the key technology behind the Single European Sky initiative.</p> <p>Indra has the in-depth experience and products necessary to undertake any Air Traffic Management programme, with both a proven international management approach and a history of responsible program execution. That experience, together with a solid technology base, permanent innovations and quality in processes and projects are the pillars sustaining Indra leadership position in Air Traffic Management, completely oriented towards Customer needs and aimed to provide our Customers with the highest level of service.</p> <p>Indra is the world leader for Flight Data Processing Systems, having supplied over 40 installations worldwide and has grown to be leader Air Traffic Management system supplier in Europe. In December 2008, Indra supplied EUROCONTROL with the new next-generation interoperable Flight Data Processing System at Maastricht Upper Area Control Centre, one of the busiest and most complex en-route Air Traffic Control Centres in Europe.</p> <p>The implementation of this Flight Data Processing System is a high technological advance directed to improve the safety, capacity, efficiency and environmental performance of Air Traffic management in Europe, and actively contributing to achieving the European's Commission Single European Sky objectives.</p>	

	<p>Indra has been selected by the most advanced European Air Navigation Service Providers to develop the future Air Traffic Management systems following the Single Sky Concept, through the iTEC Program (Interoperability Through European Collaboration). This is currently formed by ENAIRE (Spain), DFS (Germany), NATS (United Kingdom) and LVNL (The Netherlands), with Indra as industrial partner. Recent new partners are PANSA (Poland), AVINOR (Norway), Oro Navigacija (Lithuania). iTEC is currently the most advanced next-generation air traffic management system, after entering full operational service at the Prestwick control centre in Scotland</p>
Previous experience	<p>Since 2009, Indra is full member of the SESAR Joint Undertaking. In SESAR 1 Indra participated in more than 120 projects within the Programme and co-leading both WP10 (En Route and Approach ATC) and WP12 (Airports), as well as playing a key role in many projects under WP14 (SWIM), WP15 (Non-Avionics CNS) and WP13 (NIMS).</p> <p>In SESAR2020 Wave 1, Indra participated in IR/VLD Projects 01, 02, 03a, 03b, 04, 05, 06, 07, 08, 09, 10, 11, 14, 15, 16, 17, 18, 19, 20, 22, 24, 25, 27 and 31, being Project Coordinator in PJ15 and PJ18. We have also participated in other SESAR related projects (VLDs and RPAS).</p>
Entity Profile matching the task	<p>As explained in the previous sections, Indra has a solid entity profile in ATM Research due to the background knowledge, human resources and facilities to perform the R&D activities. The ATM background has continuously grown from the 80's first developments for the Spanish ATM system, to joint ventures with other ATM worldwide companies, until alliances with key European ANSPs. In term of human resources, hundreds of skilled personnel support the activities, while in terms of facilities, a significant number of laboratories and hardware resources equipped with the latest technology are used.</p>
Contribution	<p>The main contribution of Indra, as Ground Industry Supplier, will be:</p> <ul style="list-style-type: none"> • Support to the elaboration of the operational concepts, from the industrial perspective • Specification, development and testing of the Industry Base Platforms to be used by the ANSPs to perform the Validations <p>Support to the ANSPs in the Validations and in the elaboration of the conclusions</p>

4.1.1.21 LEONARDO

Organisation	12 LDO	Ground Industry
Description	<p>LEONARDO is a global player in the high-tech sectors and a major operator worldwide in the Aerospace, Defence and Security sectors. LEONARDO is based in Italy, has over 45,000 employees, of whom about 36% abroad, and in 2017 recorded 11.5 billion euro in revenues and received orders in the amount of 11.5 billion. Gianni De Gennaro has been the President since 4 July 2013 and Alessandro Profumo has been the CEO since 16 May 2017. LEONARDO designs and creates products, systems, services and integrated solutions both for the defence sector and for public and private customers of the civil sector, both in Italy and abroad.</p> <p>The wide range of defence and security solutions that LEONARDO offers Governments, private citizens and institutions includes every possible intervention scenario: airborne and terrestrial, naval and maritime, space and cyberspace. In close contact with local customers and partners, LEONARDO</p>	

	<p>works every day to strengthen global security, provide essential physical protection and cybersecurity services for people, territories and infrastructure networks and supports scientific and technological research.</p> <p>LEONARDO operates in about 20 countries with offices and industrial plants in all of the five continents and can rely on a very large network of subsidiaries, joint ventures and international partnerships, with significant industrial presence in three main markets, United Kingdom, Poland and United States and structured partnerships in the most important high potential markets in the world.</p> <p>The new LEONARDO is the culmination of a radical renewal and transformation process: from a financial holding company to a great integrated industry focused on four activity sectors:</p> <ul style="list-style-type: none"> • Helicopters • Aeronautics • Aerostructures • Electronics Defence and Security Systems • Space <p>LEONARDO operates through seven divisions that have inherited the activities of its 100% owned companies (AgustaWestland, Alenia Aermacchi, Selex ES, OTO Melara and WASS):</p> <ul style="list-style-type: none"> • Helicopters • Aircraft • Aerostructures • Airborne & Space Systems • Land & Naval Defence Electronics • Defence Systems • Security & Information Systems <p>LEONARDO also retains Parent Company and Corporate Centre functions for participated companies and joint ventures not included in the divisional scope.</p> <p>These are: the US subsidiary DRS Technologies, which deals with the supply of products, services and integrated support for the military, intelligence agencies and defence companies; ATR, the joint venture established with Airbus Group for the manufacture of regional aircraft; MBDA, the joint venture established with BAE Systems and Airbus Group for missile systems; Telespazio and Thales Alenia Space, the two joint ventures established with Thales as part of the Space Alliance, for satellite services and the manufacture of satellites and orbiting infrastructures, respectively.</p>
Previous experience	<p>Leonardo has wide experience in several SESAR 1 work packages: WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP10, WP12, WP13, WP14, WP15, WP16 and WPB. In reference to this Call, Leonardo contributed to projects P12.03.02 (Enhanced Surface Safety Nets), P12.05.02 (Airport Safety Nets and Wind Shear Detection and Alert for Controllers), P12.05.04 (Integrated Tower Working Position (iCWP) Design, Specification Prototyping and Test/Validation), P9.14 (Airport Surface Alerts), P9.13(Airport Surface Taxi Clearances - D-TAXI).</p> <p>In Wave 1, Leonardo contributed actively to PJ03a and PJ03b, which are predecessors of this Call.</p>

Entity Profile matching the task	System and Software Engineers will mainly contribute to the project with expertise of Air Traffic Management, avionic systems with particular attention to human machine interfaces. Leonardo will experiment new developments on its airport validation platform which was already successfully used in Wave 1.
Contribution	Leonardo will mainly contribute to the development of technical specifications, development of prototypes and leadership of a validation exercise.

4.1.1.22 AIRTEL ATN LIMITED

Organisation	29 AIRTEL (NATMIG)	Ground Industry
Description	North European ATM Industry Group (NATMIG, http://www.natmig.eu/) is a consortium and consists of Airtel ATN (SME - Ireland), Saab AB (multinational industrial concern - Sweden) and Stiftelsen SINTEF (non-profit research organisation - Norway), where the latter one will be the coordinator. The NATMIG partners have worked together for many years, and have in total contributed to approximately 40 SESAR 1 projects, including Exploratory Research (WP E) and contributions through Associated Members. All companies have a considerable competence and involvement in the ATM environment outside SESAR as well. In this project, SINTEF will do the planned work.	
Previous experience	No participation into the Project 2	
Entity Profile matching the task	No participation into the Project 2	
Contribution	No participation into the Project 2	

4.1.1.23 SAAB AKTIEBOLAG

Organisation	30 SAAB (NATMIG)	Ground Industry
Description	<p>SAAB AKTIEBOLAG is part of the North European ATM Industry Group (NATMIG) Consortium. The NATMIG consortium consists of Airtel ATN (SME - Ireland), Saab AB (multinational industrial concern - Sweden) and SINTEF AS (non-profit research organisation - Norway).</p> <p>While SAAB AKTIEBOLAG originates in military and civil aircraft manufacturing and is one of the few companies in the world with the ability to develop, integrate and maintain complete aircraft systems, we are today active in several transport modes and a global supplier in the ATM domain.</p> <p>SAAB AKTIEBOLAG's over 75 years of history in aeronautics, over 4000 civil and military aircraft produced and as well as our broad involvement in ATM businesses, provide a solid background and deep competence in aeronautics in general and RPAS in specific. For the future we plan to continue to be able to provide market-leading aeronautical products including manned and unmanned (RPAS) products that can operate safely in civil airspace, as well as solutions to facilitate others to allow safe RPAS operations in their airspace, whether it's an RPA, a Detect & Avoid system or related ATM components.</p>	

	<p>SAAB AKTIEBOLAG is a global supplier in the ATM domain and Saab has a long history of developing and delivering ATM solutions. SAAB AKTIEBOLAG has pioneered future concepts such as the Remote Tower, which in operational use in Sweden and is undergoing trials in several other countries. In total, SAAB AKTIEBOLAG has deployed 240 ATM systems and subsystems to serve over 60 customers in 40 countries. Our air traffic management systems and tools serve 18 of the 20 busiest airports in the world, 10 of the 12 largest Air Navigation Service Providers (ANSPs), and the 3 largest airlines by passenger count. SAAB AKTIEBOLAG ATM systems guide 2 million aircraft movements each month via our airport surface safety systems.</p> <p>SAAB AKTIEBOLAG's main areas of interest are:</p> <ul style="list-style-type: none"> • RPAS • Remote Tower
Previous experience	<ul style="list-style-type: none"> • Saab (NATMIG) has been a SESAR member from the start with the SESAR project experience: <p>SESAR 1 (WP05, WP06, WP10, WP12 and WP16): The main areas of contribution were in AMAN/DMAN, Remote Tower and safety.</p> <p>SESAR 2020 W1 (PJ05): The main area of contribution is in Remote Tower</p>
Entity Profile matching the task	No participation into the Project 2
Contribution	No participation into the Project 2

4.1.1.24 SINTEF AS

Organisation	13 SINTEF (NATMIG)	Ground Industry
Description	<p>SINTEF is a part of North European ATM Industry Group (NATMIG) Consortium. The NATMIG consortium consists of Airtel ATN (SME - Ireland), Saab AB (multinational industrial concern - Sweden) and SINTEF AS (non-profit research organization- Norway).</p> <p>SINTEF (http://www.sintef.no/) is the largest independent research organization in Scandinavia and is a non-profit research organisation. We employ 2000 people most of whom are located in Trondheim and Oslo (Norway). More than 90% of our annual turnover derives from contract research for industry and the public sector in Norway and internationally, and we receive minimal state funding (around 6%). Contract research carried out by SINTEF covers all scientific and technical areas, and ranges from basic research through applied research to commercialisation of results into new products and business ideas, for both the domestic and international markets.</p> <p>Although SINTEF DIGITAL has gained competence in state-of-the-art ATM research for several decades, the increased focus through the SESAR 1 (32 projects) and SESAR 2020 involvement has substantially improved our technology and aligned it further to the needs of the aviation industry and airspace users. The activity in SESAR has also increased SINTEF's aeronautical research portfolio outside SESAR. SINTEF is a multidisciplinary research organisation, and can still bring added value to the ATM domain through our state-of-the-art research in other domains like Oil & Gas, Space, Health & Medicine, Constructions, Energy, Marine, Railway, Roads, Harbours, and Resilience etc.</p>	

	<p>The SINTEF contribution to SESAR is focused around optimisation, (traffic sequencing, routing, taxiing, dynamic airspace, A-CDM), Human Computer Interface, system architecture and development, Digitalisation, Automation, 3D modelling, Safety, Resilience, Cyber Security and navigation (GBAS).</p> <p>SINTEF Department of Mathematics and Cybernetics have developed and operating (in collaboration with MET) the world's first and only high-resolution microscale terrain-induced turbulence alert system, which is operating at 20 Norwegian airports. SINTEF has also been working on previous SESAR project for understanding fundamental wake-terrain interactions for mitigating wake influence using high-fidelity simulations.</p> <p>SINTEF is part of project 02 solution 14. The solution aims at providing a highly accurate microscale wind predictions for terrain-induced turbulence by improving the interoperability between local and global models. This solution will create a tight integration between the different scales to create a cascade-type model in combination with The Weather Research and Forecasting (WRF) model.</p>
Previous experience	<p>Publications:</p> <ol style="list-style-type: none"> 1. Analyzing complex wake-terrain interactions and its implications on wind-farm performance. M Tabib, A Rasheed, F Fuchs. Journal of Physics: Conference Series 753 (3), 032063. 2. Wake modeling in complex terrain using a hybrid Eulerian-Lagrangian Split Solver. FG Fuchs, A Rasheed, M Tabib, E Fonn. Journal of Physics: Conference Series 753 (8), 082031. 3. Flow characterization in Complex Terrain for Aviation Safety. Rasheed A. Tabib M. World Academy of Science, Engineering and Technology , 289-297. 4. Rasheed A, Sørli, K, A multiscale turbulence prediction and alert system for airports in hilly regions, Aerospace Conference, 2014 IEEE, 2014, 1-10 , ISBN:978-1-4799-5582-4 5. Wind Farm Modeling in a Realistic Environment Using a Multiscale Approach. Rasheed A, Tabib M, Kristiansen J. ASME. International Conference on Offshore Mechanics and Arctic Engineering, Volume 10: Ocean Renewable Energy ():V010T09A051. doi:10.1115/OMAE2017-61686. <p>Previous projects:</p> <ol style="list-style-type: none"> 1. EU SESAR 12.2.2 Project. Role: Development of Hi-resolution CFD large eddy simulation model to study aircraft wake- terrain interactions for possible reduction in mitigation of wake influence. <p>Client: European Commission and EUROCONTROL with over 100 partners.</p> <ol style="list-style-type: none"> 2. Aviation Flight Safety Projects. SIMRA – an inhouse CFD code is being operated at 20 Norwegian airports for real time turbulence prediction, In addition – SINTEF hasd developed and applied computational fluid dynamics (CFD) tools to analyse the impact of buildings and complex terrains on atmospheric turbulence over flight trajectories. Sspecial analysis has been done at: 1. Sola airport, 2. Bodø airport, 3. Kristiansund airport. 4. Gimsoya airport. 5. Sondane airport 6. Ørsta-Volda airport.

	<p>3. Wind Energy FSI-WT Project (2012-2017).</p> <p>Client : Industry (Trønder Energi, StatOil) and Research Council of Norway.</p> <p>Role: Developing CFD and machine learning tools for Wind Turbine and Wind Farm, and mentoring one Ph.D. student.</p> <p>Innovation: All the three effects (thermal atmospheric stratification, complex terrain induced turbulence and turbine blade induced turbulence) have been incorporated in single model to determine the wind-farm power production.</p> <p>4. NOWITECH FME WIND Energy Project (2009-2017).</p> <p>Client: Industry (Trønder Energi, StatOil) and Research Council of Norway.</p> <p>Role: Developing CFD and machine learning tools for Wind Turbine and Wind Farm, and mentoring one Ph.D. student.</p> <p>Innovation: All the three effects (thermal atmospheric stratification, complex terrain induced turbulence and turbine blade induced turbulence) have been incorporated in single model to determine the wind-farm power production.</p> <p>5. OPWIND WIND Energy Project (2017/2020).</p> <p>Client: Industry (StatOil) and Research Council of Norway.</p> <p>Role: Developing reduced order model and machine learning tools for Wind Turbine and Wind Farm, and mentoring one Ph.D. student.</p>
Entity Profile matching the task	<p>SINTEF will work toward providing accurate wind predictions model using multiscale framework involving global weather forecasting and microscale terrain influence on wind. This work perfectly fit with the definition of the OI AO-307 and AO-324 (Dynamic Pairwise Separations for Arrival and Departure) and also AO-334, AO-315 and A0-332 (Optimised Runway Delivery for Arrival, Departure and Mix-mode),</p>
Contribution	<p>Concept description for a nested multi-scale physics-based models for microscale wind predictions.</p> <p>Accounting for local micro-scale weather conditions will be useful to meet the Safety and Performance Requirements - INTEROPerability requirements (SPR3 -INTEROP)/ Operational Service and Environment Definition (OSD) in a weather-based dynamic minima separation. The objective of this task is to enhance the accuracy of microscale wind and turbulence prediction through model development involving nested multi-scale physics-based models. The nested solution aims at providing a highly accurate microscale wind predictions by coupling and improving the interoperability between global (meso-scale weather forecasting model) and local wind models (macro-scale and micro-scale terrain-resolving CFD models). Thus, this solution will create a tight integration between the different scales to create a cascade-type (nested) models. A framework will be set-up to demonstrate the model and its validation with known experimental dataset.</p>

4.1.1.25 NATS (EN ROUTE) PUBLIC LIMITED COMPANY

Organisation	14 NATS	Service Provider
Description	<p>NATS (En Route) plc is the core business and the sole provider of ATC services for aircraft flying 'en route' in UK airspace and the eastern part of the North Atlantic. NATS manages 11% of Europe's airspace and circa 25% of Europe's traffic. It is regulated by the UK Civil Aviation Authority (CAA) within the framework of the European Commission's (EC) Single European Sky (SES) and operates under licence from the UK Secretary of State for Transport. It operates from two ATC centres at Swanwick in Hampshire (England) and Prestwick in Ayrshire (Scotland).</p> <p>NATS (En Route) plc purpose is to provide safe, efficient and effective air traffic control services to aircraft operating within airspace where such services are either required or provided, specifically providing:</p> <ul style="list-style-type: none"> • En-route and Terminal Air Traffic Control (ATC) for all UK airspace under a 30 year operating licence to UK Government. In 2017, NATS handled over 2.5 million flights, carrying more than 200 million passengers safely through some of the busiest and most complex airspace in the world. • The design and management of airspace, engineering project and maintenance activities for ANS communications, navigation and surveillance systems, and IT and network management. • Cross business support to UK Ministry of Defence (MoD) which includes the provision of a joint ATC service in the UK FIR, and support to communications systems, radar, facilities and training. • Provision of Instrument Flight Procedure design services, publication of the International Air Pilot Publication (IAIP), Notice to Airmen (NOTAM) documentation, data management and charting services for the UK. • Consultancy services to UK and overseas customers in air traffic management, airspace design, instrument flight procedures, control tower system integration and transition, safety management, engineering, project management. • Training of ATC staff, both as ab-initio controllers, for transition to new airspace or facilities and via supplementary courses including Supervisor Management, On Job Training (OJTI) and Incident Management. • Training of engineering staff. 	
Previous experience	<p>Deployed Products:</p> <ul style="list-style-type: none"> • Time Based Separation (TBS) deployed at London Heathrow in 2015. • Tool supported RECAT-EU with Optimised Runway Delivery (ORD) deployed at London Heathrow in 2018 as part of the Enhanced Time Based Separation (eTBS) project. • Non-tool supported RECAT-EU departure separations deployed at London Heathrow in 2018 <p>Publications:</p> <p>D. Galpin, C.Pugh, D. Cobo, L. Vinagre, European Wake Vortex Mitigation Benefits (EuroBen) study, EUROCONTROL One Sky. The EuroBen study performed a cost benefit analysis of 3 wake related concepts; Time Based</p>	

	<p>Separation (TBS), ATC-Wake (weather dependent concept for arrivals) and CREDOS (weather dependent concept for departures).</p> <p>Previous projects:</p> <p>SESAR 1</p> <p>Key contributor to</p> <ul style="list-style-type: none"> • P6.8.1 “Flexible and Dynamic Use of Wake Vortex Separations” and • P6.8.8 “Enhanced Arrival procedures enabled by GBAS”: <p>SESAR 2020 W1 (PJ02):</p> <ul style="list-style-type: none"> • Solution lead for PJ02-01 “Wake Turbulence Separation Optimisation in SESAR2020”. • Contributor to PJ02-03 “MRS” <p>CREDOS (FP6, 2006-2009): cross-wind reduced departure separations</p> <p>RESET (FP6, 2006-2010), Reduced Separation Minima</p> <p>Wakenet3 (FP7, 2008–2012): a thematic network to discuss and disseminate information on wake turbulence matters. NATS led the ‘Operational Concepts’ coordination area.</p> <p>In addition, NATS are members of the ICAO Wake Turbulence Study Group (WTSG) and European Wake Vortex Task Force (WVTF).</p>
<p>Entity Profile matching the task</p>	<p>NATS has significant experience in Airport Airside and Runway Throughput from initial research through to implementation. NATS has been a key contributor in this area in SESAR 1 and SESAR 2020, Wave 1.</p> <p>NATS has built on SESAR success through deployment of SESAR concepts into operations, including Time Based Separation (TBS) in 2015 and subsequently in 2018 Optimised Runway Delivery (ORD) utilising time-based RECAT-EU minima. This has demonstrated significant benefits to runway throughput and has proven benefits in reducing aircraft delays, aircraft emissions and fuel burn and increasing the resilience of the operation to weather related delays and the associated environmental, fuel benefits to airlines, airport operators and airspace users. These projects have demonstrated the improved safety of operations and showcase delivery of SESAR into operations.</p> <p>NATS deployment of SESAR concepts has demonstrated SESAR Pilot Common Project (PCP) deployment AF2 Airport Integration and Throughput, 2.3.1. Time Based Separation in compliance with EU Regulation 716/2014.</p> <p>In SESAR 1 NATS were heavily involved in the concept design, organisation of workshops on concept, safety and human performance and performing validation exercises on Time Based Separation (TBS), Static Pairwise Separations (S-PWS) and Optimised Runway Delivery (ORD).</p> <p>NATS is continuing to perform further research in the Airport and Runway Throughput area in SESAR2020 through the validation of Static Pairwise separations for departure (S-PWS-D), Weather dependent separations on departure (WDS-D) both of which are enabled by an Optimised Separation Delivery (OSD) departure tool.</p> <p>NATS wishes to continue this work through the Airport Airside and Runway Throughput project in SESAR 2020 Wave 2 building on the tools and concepts developed in SESAR2020 Wave 1. In particular this would be to address the</p>

	<p>loss of efficiency and capacity due to the current resolution of separation rules and the uncertainties of aircraft parameters by consideration of downlinked flight specific data. In addition NATS envisages the use of departure LiDAR data being collected at London Heathrow could be used to support the safety evidences for the regulatory approval of S-PWS-D. This approval is an essential part of stakeholders being able to deploy the concepts being developed. The LiDAR data would also provide measured objective data to support the definition of dynamic separations on departure such as differential rotation point.</p>
Contribution	<p>NATS will investigate the use of downlinked flight specific data, for example through EPP to provide certainty into current separation rules and tools to address efficiency and capacity lost through current assumptions and buffers. NATS will develop a proposed method of operations for using such data, will review any analytical performance assessment with respect to the spacing efficiency and capacity of the ORD tool, and will develop technical specifications for ORD enhancements.</p> <p>On the assumption that there will be a flight simulator campaign within Solution 14 designed to provide safety evidence for regulatory approval of S-PWS-D, which is considered essential for stakeholders to be able to deploy S-PWS-D; NATS would perform analysis on wake encounter report data and departure LiDAR (wake measurement) data from London Heathrow (through HAL/SEAC) to provide location and strength information of departure vortices. This will be used to derive a wake encounter severity metric, such as Rolling Moment Coefficient RMC from Lidar data for a range of possible encountering aircraft. It is envisaged that the results of the Lidar analysis will be used in conjunction with a flight simulator study (EUROCONTROL) to ensure and confirm that the pilot interpretation of wake severity metrics (eg for a range of RMC values) on departure are acceptable and consistent with the design separations. NATS would organise and execute workshops and/or meetings/web-exs to ensure that the analysis work was integrated with the requirements of the flight simulator study.</p> <p>NATS will also use the London Heathrow departure LiDAR data to support the concept development of dynamic separations on departure such as differential rotation points. NATS will execute a V1 validation exercise on this concept to understand the safety and human performance issues and to develop a method of operations.</p>

4.1.1.26 AEROPORTS DE PARIS

Organisation	31 ADP (SEAC2020)	Service Provider
Description	<p>Groupe ADP (formerly Aéroports de Paris) manages the 3 Paris airports:</p> <ul style="list-style-type: none"> • Paris-Charles de Gaulle, 2nd largest airport in Europe and 10th worldwide, • Paris-Orly, 2nd largest airport in France, dedicated to point to point traffic, • Paris-le Bourget, the leading business airport in Europe. 	

	<p>and 10 aerodromes in the Paris area plus one heliport. Paris airports welcomed 101,5 million of passengers in 2017 and 105,3 million of passengers in 2018, serving more than 3570 destinations.</p> <p>ADP (SEAC2020) also manages directly or indirectly 26 airports worldwide (228,2 million of passengers in 2017) and exports its know-how and expertise to 4 continents.</p> <p>According to the latest study conducted by the BIPE (bureau for economic information and forecast) in 2011, the overall economic activity generated by the Paris airport system was 5.8% of the one of Ile-de-France (Paris region) GDP, i.e. 1.7% of the French GDP. With 340,300 jobs, the economic activity generated by the presence of the Paris airports represents 8.3% of paid employment in Ile-de-France, i.e. 2% of paid employment in France. The direct employment associated with companies present at the airports represents 1/3 of these jobs, i.e. 115,400 jobs, of which 96% are long-term contracts.</p>
Previous experience	<p>Previous projects:</p> <ul style="list-style-type: none"> - SESAR 1 WP06: P6.5.4 project manager (APOC definition), contribution to P6.7.1/P6.3.1 (RWSL aspects) and to 9 individual project in WP06; OFA.05.01.01 Core Team (Airport Operations Management). - SESAR 1 WPC: contributions to cost benefit analysis (C.2), - SESAR 1 WP16: contribution on environmental aspects addressed by WP16 (P16.3.1 and P16.3.2). - SESAR 2020 W1 (PJ04): Project coordinator, contribution to solutions PJ.04-01 and PJ.04-02. - SESAR 2020 W1 (PJ03b): Project contributor to PJ.03b-06
Entity matching the task	<p>In addition to managing the operations on a day-to-day basis, Group ADP (ADP(SEAC2020)) has unique skills, knowledge and experience within airport operations and ATM including:</p> <ul style="list-style-type: none"> • Operating a large, busy complex hub airport, • Integrated Airside & Landside Operations, • Capacity Management & Enhancement, • Strategic Planning & Forecasting, • Performance Management, • Information Technology, • Environmental Management in varying weather conditions, • Contingency & Crisis Management. <p>Group ADP (ADP (SEAC2020)) will provide specific airport expertise based on the knowledge and experience of large airport operations.</p>
Contribution	<p>Group ADP (ADP(SEAC2020)) will lead the PJ.04 project (Total Airport Management). Group ADP will also contribute to project PJ04 (both solutions #28 and #29) by bringing in its knowledge and experience of current airport operations management both airside and landside, as well as its knowledge and experience gathered from previous SESAR program phases (SESAR 1 and SESAR2020 W1).</p>

Active contribution will be provided by Group ADP in both concept development of PJ.04 solutions #28 and #29, as well as in the preparation and execution of validation exercises.

4.1.1.27 AVINOR AS

Organisation	15 Avinor (SEAC2020)	Service Provider
Description	<p>Avinor AS (AVINOR(SEAC2020)) is a state-owned limited liability company tasked with facilitating safe, environmentally friendly, and efficient aviation across Norway. Operations encompass a network of 45 airports and air navigation services throughout Norway.</p> <p>53 million passengers travelled to or from Avinor's airports (scheduled, charter, and offshore) in 2017. There was a total of 697,000 movements (take-offs and landings) at Avinor's airports in 2017. Oslo airport is the hub of Norwegian aviation and a transit airport for traffic between Norway and the rest of the world. The profit generated by Oslo airport is crucial for the financing of the network of airports spread across the rest of Norway. 27.5 million passengers used Oslo airport in 2017.</p> <p>Avinor AS (AVINOR(SEAC2020)) has built world-leading expertise in its development and operation of a network of many small and large airports in a challenging climate and topography. The company is used to implementing multi-airport solutions in a cost-efficient way.</p>	
Previous experience	<p>Avinor AS (AVINOR(SEAC2020)) has participated in multiple projects during SESAR 1 and SESAR 2020 Wave 1:</p> <ul style="list-style-type: none"> - SESAR 1 06.05.04 –Airport Operations Centre Definition (VALP, VAL EXE, VALR), - SESAR 1 06.06.02 –Integration of airport - airline/ground handlers - ATC processes (incl. turnaround) in ATM (SPR, VALP, VAL EXE). - SESAR 2020 W1 (PJ04): Project contribution to solutions PJ.04-01 and PJ.04-02. - SESAR 2020 W1 (PJ02): Project contributor to PJ02-11 (OSED task lead) 	
Entity Profile matching the task	<p>Avinor AS (AVINOR (SEAC2020)) operates an airport network with Oslo Airport as an important node. The 45 airports of the network have produced a diverse understanding of the airport management issues and their dynamic effects within airports and on multiple stakeholders, most importantly passengers and airspace users. Among others, Avinor AS (AVINOR-SEAC2020) has extensive experience in addressing themes such as:</p> <ul style="list-style-type: none"> - Performance management, - Innovation and technology development, - Information management including decision support systems, - Winter weather operations, - Resilience Engineering, - Landside and Airside integration, - Environmental Management 	

Contribution	Avinor AS (SEAC2020) will contribute to PJ04 for solution 28 and 29. It will participate in concept development and participate in the preparation and execution of validation exercises. Where applicable Avinor AS (AVINOR (SEAC2020)) will provide operational data as well as operational experts for simulation/gaming activities as part of the planned validation exercises.
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4.1.1.28 HEATHROW AIRPORT LIMITED

Organisation	16 HAL (SEAC2020)	Service Provider
Description	<p>Heathrow is the UK's premier international airport and one of the world's major hub airports flying people for business, tourism and to visit friends and relatives around the world. We provide the infrastructure and services for over 80 airlines flying 80 million passengers a year to over 204 destinations worldwide. Heathrow is also an important national economic asset for London and the UK, supporting our capital city and contributing an estimated £3.3 billion annually to the UK economy. As one of the largest single site employers, there are over 76,500 people working at Heathrow for over 400 companies, and we are the UK's largest port by value too, with around £86 billion of UK goods exported annually through the airport.</p> <p>Heathrow sits within the largest long-haul travel market in the world connecting business and people across the UK to growing economies around the world and is the UK's gateway for international tourism and travellers. We offer excellent passenger service through our two newest Terminals – Terminal 5 and Terminal 2 – and through upgrades to Terminals 3 and 4. We are currently voted by passengers through Skytrax to have the world's best airport terminal for terminal 2, and to have the World's best airport shopping, to be the best airport in Western Europe and to be in the World's top 10 airports. We are commitment to be a responsible airport, being a good neighbour to our local communities and taking a lead on environmental measures, giving passengers a strong reason to keep choosing Heathrow. The UK government have recently approved Heathrow's expansion plans with 70% of MPs in support of the development.</p>	
Previous experience	<p>Along with its airport partners in SEAC, Heathrow Airport Limited (HAL (SEAC2020)) referred to as HAL in this section, demonstrated a substantial involvement in the SESAR 1 programme and showed strong leadership particularly in developing the Airport Operations Management concept.</p> <p>HAL participated in eight WP6 "Airport Operations" projects addressing topics such as the integration of airport processes including the turnaround phase, definition and development of the APOC, integrated validation activities for the airport in the ATM environment, GBAS operational implementation and collaborative airport planning. Additionally, HAL provided effort to the WP6 management (06.00) and federating (06.02) projects to ensure consistency of results being passed to transversal documents, performance goals and other ATM stakeholders. HAL provided leadership to OFA05.01.01 (Airport Operations Management) to develop new solutions for testing, validation and eventual deployment into live airport operations.</p>	

	<p>HAL developed innovative concepts such as the Airport Operations Plan (AOP) and Airport Operations Centre (APOC), which have now been introduced into the current baseline for Airport Collaborative Decision Making (A-CDM). The APOC and AOP are successfully operating at Heathrow and will be used in Wave 1 as part of the VLD PJ24 to validate Target Time of Arrival Management (TTA) using Demand Capacity Balance (DCB) tools. User Driven Prioritisation (UDPP) has also been developed in the AOP. HAL is involved therefore in practical AOP/NOP data exchanges to facilitate a seamless integration of airports into the Network. In SESAR 2020 Wave 1 HAL has further developed the concept contributing to PJ04 Solution 1 New Operating Methods and Solution 2 concept development.</p> <p>HAL also participated in transversal projects in PJ20 and contributed to all aspects of the development of the ATM Master Plan 2018.</p>
Entity Profile matching the task	<p>In addition to managing the operations on a day-to-day basis, HAL (SEAC2020) has unique skills, knowledge and experience with respect to airport operations and ATM including:</p> <ul style="list-style-type: none"> • Operating a large, busy complex hub airport, • Integrated Airside & Landside Operations, • Capacity Management & Enhancement, • APOC operations with an integrated AOP • Strategic Planning & Forecasting, • Performance Management, • Information Technology, • Environmental Management in varying weather conditions, • Contingency & Crisis Management. <p>HAL (SEAC2020) will provide specific airport input based on the knowledge and experience of a capacity constrained airport located in a capacity constrained Terminal Manoeuvring Area within the core area of the European ATM system.</p>
Contribution	<p>HAL (SEAC2020) will contribute to project PJ02 by bringing in its knowledge and experience of current airport operations management, airside and landside, its knowledge and experience from actual APOC and AOP operations and its extensive knowledge of innovative future developments.</p> <p>Specifically, for this project SEAC has experience of dealing with peak periods of operation where we schedule and operate based on minimum wake vortex separation. In addition, we are experienced, high-performing airports and believe that our input into this project will help us to optimise our runway operations in line with local, national and international environmental and political conditions, and that this requires integration with advances in arrival, surface and departure management solutions, which will</p>

in turn allow us to perform local capacity performance assessments which can be fed into the Network. HAL will also be a case study provide data for traffic mix or pairwise separation and the evolution of the runway lighting system. HAL will work on the benefits case for differentiated rotation position and weather dependent separations. HAL will provide input to enablers associated with DCB and airport management.

4.1.1.29 FLUGHAFEN MUNCHEN GMBH

Organisation	32 MUC (SEAC2020)	Service Provider
Description	<p>Flughafen München GmbH (MUC (SEAC2020)) is the operating company of Munich Airport. Within just a few years of opening in 1992, the airport's outstanding growth performance elevated it to join the ranks of Europe's busiest passenger airports. Munich Airport is a 26-year success story. It has a track record for steady growth, from 12 million to 46 million passengers per year, and from an airport to a self-contained city.</p> <p>Our company has significantly expanded its business activities: We're not only an international hub, but rather an urban centre offering a wide range of goods and services. More and more, we're marketing the airport as a world of experience as well as offering real estate and consulting services. Services are offered far beyond Munich.</p> <p>The essence of our brand, Living ideas – Connecting lives, sums up everything that Munich Airport stands for and is an ideal expression of the multifaceted character of the airport. We connect people in every sense of the word: As an international hub we connect people on every continent. As a high-efficiency cargo airport we connect global markets. Together with our partners we connect strengths, competencies and innovations. And internally we are connected within the airport family. But Living ideas – Connecting lives means more than that: The core of our brand stands for a spirit of partnership in dealings with external parties, not only with our business partners, but also with the airport's neighbors and the residents of Munich. It also stands for the commitment of all employees to the way we, as the FMG Group, intend to behave in the future, both internally and externally – to an inner attitude.</p>	
Previous experience	<p>Flughafen München GmbH (MUC (SEAC2020)) was involved in SESAR 1 with a focus on concept development and validation activities. This is reflected with a participation in the 6.2, operational concept definition where we have put an emphasis on Validation Strategy and DoD. Furthermore we participated in 6.5.2, Airport Operations Plan Validation and 6.5.4, APOC Definition. Another strong focus was projects 6.6.1, CDM in adverse conditions and 6.7.2/6.7.3 ASMGCS Routing, Planning and Guidance. The main focus, however, was in 6.3 projects on validation, where we had placed most of our effort. In April 2015 we have hosted our own validation exercise on “Follow-the-Greens” (FtG) which turned out to be very successful with FtG established as a standard solution in the ATM Masterplan later on. Particular attention was also made to transversal activities with participation in C2 in various work packages and being the airport representative in the Masterplan campaign.</p> <p>In SESAR 2020 we have been involved as contributor mainly in PJ04 TAM, PJ03a ASMGCS and PJ20 Masterplan Update.</p>	
Entity matching the task	Profile	Not applicable, Flughafen München GmbH (SEAC2020) initially will not participate directly in this action.
Contribution	Support to participating SEAC2020 members when required.	

4.1.1.30 SCHIPHOL NEDERLAND B.V.

Organisation	33 SNBV (SEAC2020)	Service Provider
Description	<p>Schiphol Nederland B.V.(SNBV) is the operator of Schiphol Airport; one of the busiest and largest hub airports in Europe. Started in 1916 as a small military airfield, Schiphol Airport has evolved towards a world class airport by continuous adaption to and initiation of new and innovative process developments in the Air Transport Industry.</p> <p>In 2018 Schiphol Airport welcomed over 71 million passengers, using almost 500.000 flights to/from 322 destinations worldwide. For this Amsterdam Airport consists of a complex system of terminals, concourses, aircraft parking aprons and runways.</p> <p>Schiphol Airport has a complex infrastructure lay-out consisting of six runways, many of them converging or even crossing. The operating environment is unique in such that runway combination changes take place 15 to 20 times a day. Not only dictated by a pronounced demand asking the full capacity of three runways simultaneously (2 landing + 1 take-off runway during inbound peak periods and 1 landing + 2 take-off runways during outbound peak periods), but also dictated by strict environmental regulations limiting the use of certain runways.</p> <p>Schiphol Nederland B.V. is part of the Schiphol Group. Next to Schiphol Airport, the smaller Dutch airports of Rotterdam, Eindhoven and Lelystad are part of the group. Schiphol Group also operates the International Terminal T-4 at New York JFK</p>	
Previous experience	<p>Schiphol Nederland has a strong involvement in the SESAR 1 program, being involved in 10 projects of Work Package 6 “Airport Operations”. Among a long list of contributions and activities this includes:</p> <ul style="list-style-type: none"> • Project management of P6.5.1 (Airport Operations Plan Definition); AOP • Contributor to P6.5.3 (Airport Capacity and Flow Management); Airport - DCB • Contributor to P6.5.4 (Airport Operations Centre definition); APOC • Contributor to the development of the OFA 05.01.01 “Airport Operations Planning” guidance documents OSED and INTEROP. • Contributor to the development of the validation plans (VALP) for different validation exercises for AOP, APOC and Airport-DCB (RMAN – Runway Manager), • Contributor to the execution of validation exercises for AOP, APOC and Airport-DCB (RMAN). • Task-leader / co-writer activities for multiple tasks within projects of Work Package 6 including P6.2 - Initial Detailed Operational Description – DOD step 1 and P6.5.4 APOC Initial Operational Concept. <p>In SESAR2020 Wave 1 Schiphol Nederland B.V. continued the work from SESAR1 and took the task lead for the SPR-INTEROP/OSED together with NLR. The projects Schiphol Nederland B.V. was involved in SESAR2020 are:</p> <ul style="list-style-type: none"> • Task Lead for SPR-INTEROP/OSED PJ04-01 TAM • Contributor in PJ04-02 TAM • Contributor in PJ-09 DCB • Contributor in PJ-20 Masterplan 	

Entity matching the task	<p>Profile</p> <p>As one of the main hub- airports in Europe, Schiphol Nederland has extensive experience with respect to Airport Operations and Air Traffic Management, including;</p> <ul style="list-style-type: none"> • (Integrated) Airside & Landside Operations, • Capacity Management & Enhancement, • Infrastructure Design & Construction, • Strategic Planning & Forecasting, • Performance Management, • Information Technology, • Safety Management, • Environmental Management in varying weather conditions, • Political and Regulatory Affairs, • Contingency & Crisis Management. <p>Schiphol Nederland employs skilled staff with a wide variety of expertise in operating a complex and busy airport. Skills vary from day-to-day operational management to implementing new or improved infrastructure and procedures in a 24/7 operational environment.</p>
Contribution	<p>Schiphol Nederland will contribute to project PJ04 by bringing in its knowledge and experience of current airport operations management both airside and landside, its knowledge and experience from SESAR -1 and SESAR2020 W1.</p> <p>Active contribution will be provided by Schiphol Nederland in the concept development of both solution 28 and 29 as also in the preparation and execution of a large number of validation exercises.</p> <p>Schiphol Nederland will provide a leading contribution in the operational concept development (OSD) within a solution.</p>

4.1.1.31 SWEDAVIA AB

Organisation	17 Swed (SEAC2020)	Service Provider
Description	<p>Swedavia AB (Swedavia (SEAC2020)) task is to own, operate and develop ten strategically located airports all over Sweden. Together, the airports constitute a network that links Sweden's regions together, while also serving as a bridge to and from the world beyond. Swedavia's vision is "Together we bring the world closer". That means Swedavia shall help to make air travel and cargo transport – regionally, but also to and from Sweden – as accessible, efficient and attractive as possible.</p> <p>In 2018, Swedavia AB (Swedavia (SEAC2020)) had a net revenue of SEK 5.9 billion and some 3,000 employees. The Swedavia group of airports served in 2018 around 42 million passengers.</p> <p>Stockholm-Arlanda Airport is Sweden's largest airport (26,7 million passengers and 916 000 aircraft movements in 2018) and acts as an important domestic and international hub for the Stockholm region and for Scandinavia - owing to flights to 180 destinations around the globe, and good ground transportation to and from other parts of the Stockholm region.</p> <p>Stockholm-Arlanda Airport operates three runways which are subject to strict environmental conditions. Capacity is in 2018 84 aircraft movements per hour. In total some 20,000 people work at the airport.</p>	

Previous experience	<p>Swedavia AB (Swedavia (SEAC2020)) has been involved since SESAR1 as a member of NORACON. Swedavia AB (Swedavia (SEAC2020)) was an active in a number of Work Package 6 projects both as project leader and as project contributor. Swedavia AB (Swedavia (SEAC2020)) has also been involved in validation exercises under the SJU/AIRE umbrella. Examples of various Swedavia (SEAC2020) engagement below:</p> <ul style="list-style-type: none"> • WP6.6.2 as Project Leader for “Integration of Airport/Airline/Ground Handlers/ATC. <p>Swedavia AB (SEAC2020) has been contributing to:</p> <ul style="list-style-type: none"> • WP6.7.1 “Airport safety support tools”, • WP6.8.8 “Enhanced arrival procedures to “reduce occupancy time using GBAS & P03 - Curved Approach based on GBAS, • WP6.9.3 “Remote & Virtual tower. <p>Swedavia AB (Swedavia (SEAC2020)) airports (Stockholm-Arlanda airport / Göteborg-Landvetter airport) have been participating in SJU/AIRE exercises “Green Connections”, “MINT” and “VINGA”.</p> <ul style="list-style-type: none"> • Swedavia AB (Swedavia (SEAC2020)) have been involved as consortium member and as contributor in two FP7 financed projects “MANaging System Change in Aviation, MASCA” and project “PROactive Safety PERformance for Operations, PROSPERO • In SESAR2020 Swedavia AB (Swedavia (SEAC2020)) joined the SEAC consortium where Swedavia AB (Swedavia (SEAC2020)) have contributed in: <ul style="list-style-type: none"> • PJ02/11 – EARTH • PJ04 – TAM • PJ05 – Remote Tower • PJ20 – ATM Masterplan <p>Within PJ04, Swedavia AB (Swedavia (SEAC2020)) have focused on assisting other partners with operational expertise and personal for validation activities.</p>
Entity Profile matching the task	<p>Swedavia AB (Swedavia (SEAC2020)) operates large, medium-sized and small regional airports. As such Swedavia AB (Swedavia (SEAC2020)) has extensive experience in cooperating with various other airport stakeholders, such as local ANSPs, Ground Handlers and Airspace Users, to provide a smooth and safe aircraft ground handling processes. Swedavia AB (Swedavia (SEAC2020)) is engaged in Airports Council International (‘ACI Europe’) and it is through a relationship with both the SEAC2020 Consortium and ACI that communication and consultation will be achieved for the airports outside of the formal Consortium arrangements.</p> <p>Examples of unique skills, knowledge and experience with respect to airport operations and ATM at Airports, includes:</p> <ul style="list-style-type: none"> • Operating large, medium and regional airports, • Airside & Landside Operations, • Winter operations at airports of different sizes,

	<ul style="list-style-type: none"> • Capacity Management & Enhancement, • Strategic Planning & Forecasting, • Performance Management, • Information Technology, • Safety Management, • Environmental Management in varying weather conditions • Contingency & Crisis Management. <p>Swedavia uses a general simulation model for runway usage, by use of the simulation program CAST. CAST is an airport specific modular platform, which can simulate aircraft traffic and process flows. The CAST simulation program is well known within the industry and is a product, based on development and cooperation amongst several partners, such as EUROCONTROL, BAA, Airbus/Ariane amongst others.</p> <p>Swedavia have in-house capabilities for Instrument Flight Procedure design, and vast experience in the PBN domain.</p>
Contribution	Swedavia AB (Swedavia (SEAC2020)) will take the leadership of solution 4 and will actively contribute to the various activities intended in Solution 4 by providing airport operations and vast ATM knowledge and expertise. Swedavia will also be visible for one of the validation activities in Solution 4 (a FTS).

4.1.1.32 FLUGHAFEN ZÜRICH AG

Organisation	34 ZRH (SEAC2020)	Service Provider
Description	<p>According to the terms agreed with the Swiss Confederation in 2001, Flughafen Zürich AG (SEAC2020) has the right and obligation to operate Zurich Airport and maintain its infrastructure for the duration of the 50-year concession. The 2004 aviation policy report summarised the Federal Council's position: "Because Zurich Airport is a key infrastructure, it is vital for Switzerland that it runs smoothly. It must continue to provide the infrastructure that airlines need to maintain the best possible direct connections between Zurich and Europe and the world's major cities and to thereby satisfy the needs of the market".</p> <p>Flughafen Zürich AG (SEAC2020) has around 1,600 employees across four business areas. The company focuses on its core activities: national and international airport operator, operation of the commercial centres in the landside and airside areas, as well as income-oriented management and further development of real estate at the Zurich location.</p> <p>In the formulation and implementation of its strategy, Flughafen Zürich AG (SEAC2020) underpins the three aspects of cost-efficiency, environment and social responsibility. In this way it aims to increase the company's competitiveness and credibility and achieve sustainable value creation. It constantly has to strike a balance between capacity, complexity and noise activities.</p>	
Previous experience	Flughafen Zürich AG (SEAC2020) participates to SESAR through the SESAR European Airports Consortium and was mainly involved in WP6 Projects; 6.8.4 Coupled AMAN DMAN, 6.5.3 Airport-DCB, 6.5.1 Airport Operations Plan	

	<p>Definition, 6.5.4 Airport Operations Centre definition and the OFA 5.1.1, as well as in the projects 6.7.1. and 6.7.2 and the Validations of 6.3.1 and 6.3.2.</p> <p>Additionally Flughafen Zürich AG (SEAC2020) provided effort to the management of WP6 and to the federating 6.2 project to ensure consistency of results being passed to transversal documents to determine performance goals and inform other ATM stakeholders.</p> <p>Additionally Flughafen Zürich AG (SEAC2020) took part in WP12 “Airport Systems” project 12.06.02 Airport Operations Plan and several environmental projects. Furthermore Flughafen Zürich AG (SEAC2020) has been involved in the BAFO III project 6.8.8 and in several AIRE projects (AIRE 1 and AIRE 2) covering ground aspects and the LSD projects iStream & AAL.</p>
Entity Profile matching the task	<p>As the main hub- airport in Switzerland, Zurich Airport has extensive experience with respect to Airport Operations and Air Traffic Management, including;</p> <ul style="list-style-type: none"> • (Integrated) Airside & Landside Operations, • Capacity Management & Enhancement, • Infrastructure Design & Construction, • Strategic Planning & Forecasting, • Performance Management, • Information Technology, • Safety Management, • Environmental Management in varying weather conditions, • Political and Regulatory Affairs, • Contingency & Crisis Management. <p>Flughafen Zürich AG (SEAC2020) employs skilled staff with a wide variety of expertise in operating a complex and busy airport. Skills vary from day-to-day operational management to implementing new or improved infrastructure and procedures in a complex operational environment.</p>
Contribution	<p>Flughafen Zürich AG (SEAC2020) will contribute to project PJ04 by bringing in its knowledge and experience of current airport operations management, its knowledge and experience from SESAR 1 and its extensive knowledge of future developments.</p> <p>Flughafen Zürich AG (SEAC2020) contribution will focus on solution #29. It will participate in the preparation and where required to the execution of relevant validation exercises. Where applicable Flughafen Zürich AG (SEAC2020) will provide operational data as well as operational experts for simulation/gaming activities as part of the planned validation exercises.</p>

4.1.1.33 THALES LAS FRANCE SAS

Organisation	18 THALES AIR SYS	Ground Industry
Description	<p>Thales ATM, from take-off to touchdown and everything in between.</p> <p>World leader in ATM, Thales, represented in SESAR 2020 by the Thales LAS France company and its Linked Third Parties, offers integrated gate-to-gate solutions, from pre-flight to landing, ensuring airport safety, efficient traffic handling operations, data sharing on aircraft and seamless handover operations</p>	

	<p>between territories. Thales has the largest installed base of solutions and technologies with over 360 TopSky - ATM Solutions, 7,000 nav aids, 700 surveillance radars, and 1,800 ADS-B and multilateration equipment.</p> <p>Thales is trusted by key ATM decision makers across 170 nations, and helps key decision makers master complexity and make timely decisions for better outcomes.</p> <p>At the forefront of all major modernisation initiatives around the world</p> <p>Growing aircraft numbers make Air Traffic Management more complex. Thales solutions help to make the skies safer, greener and more efficient.</p> <p>A key player in all major ATM modernisation initiatives, ICAO Aviation System Block Upgrades (ASBU), SESAR and NextGen, Thales focuses on international harmonization. Our product roadmaps are aligned with ICAO ASBU concepts, NextGen and SESAR.</p> <p>Thales has an important experience in En-Route, Approach and Tower systems developing and deploying systems across the world.</p>
Previous experience	<p>Previous main projects:</p> <p>SESAR 1: Thales has been involved in all SESAR 1 WorkPackages. Thales has been Co-Leader for :</p> <ul style="list-style-type: none"> • WP10 (En-Route & Approach ATC Systems) • WP 14 (SWIM technical architecture) • WP15 (Communication, Navigation, Surveillance) <p>SESAR 2020 Wave 1: THALES is a key contributor to the programme and is being involved in all S2020 Wave 1 projects.</p> <p>Thales is project coordinator for :</p> <ul style="list-style-type: none"> • PJ16 (Controller Working Position / Human Machine Interface) • PJ17(SWIM Technical Infrastructure) <p>4-FLIGHT: Thales is delivering the future innovative Air Traffic Management system for France, 4-Flight. DSN A will enjoy a new generation ATM system to respond to the increasing complexity and density of air traffic, integrating a new advanced flight data processing system (CoFlight) with Thales's latest generation human machine interface (TopSky - Controller HMI) and sophisticated new controller tools, to better detect conflicts, facilitate traffic analysis.</p> <p>COFLIGHT: Coflight is a new advanced Flight Data Processing System (FDPS), jointly developed by DSN A and ENAV and Skyguide ANSPs, together with industrial partners Thales and Leonardo. Designed to meet</p>

SESAR performance objectives, Coflight is a unique product, a fundamental enabler to achieve interoperability throughout Europe.

COOPANS (CO-Operation of Air Navigation Service providers) is a unique innovative partnership, between five major ANSPs together with Thales as industry provider. IAA, LFV, Naviar, Austro Control and Croatia Control have implemented an advanced and unified Air Traffic Control system thanks to harmonized functionalities and joint investments. With Thales TopSky - ATC system in operation, the five countries members benefit from a unified solution, through an open architecture which allows them to introduce the latest innovations via regular stepwise evolutions.

OneSKY: The OneSKY project for the Australian ANSP Airservices of Australia consists of merging civil and military airspace into one unique airspace managed by the same integrated system. It is the most complex 'system of system' project that THALES ATM has ever competed for, including TopSky - ATC solutions deployed in 15 interconnected civil and military ATC centres.

MARSHALL: The Marshall Project is a transformational infrastructure programme for UK MoD, seeking to ensure safe, efficient and sustainable Air Traffic Management (ATM) service for the UK Armed Forces. Thales provides a complete civil ATM capability for Military Airbases with:

- Efficient and secure solutions for Approach, Tower and Runway operations
- A totally harmonized solution for operations between civil and military ATC
- Civil-military data control

TAAATS: provides the Air Traffic Management Service (En-Route and Approach) for the whole of Australia and for the related oceanic areas as well as the civil-military co-ordination. It is the only system in the world that simultaneously provides fully integrated ADS/CPDLC facilities and allows integrated display of radar tracks, ADS-C tracks, ADS-B tracks and Flight Plan tracks.

NESACC: aims at providing the Air Traffic Management Service (En-Route and Approach) for the whole north east of China controlling around 60% of Chinese total air traffic. Air traffic control of areas outside radar coverage is also provided. The Beijing, Shanghai and Guangzhou ATC centres are connected to the three (3) control towers of the largest Chinese airports.

MODERNISATION INITIATIVES

NextGen

Thales has a unique position in the ATM Industry, participating to both SESAR and NextGen. NextGen is transforming the US National Airspace System (NAS) to meet future needs and avoid gridlock in the sky and at airports.

	<p>Thales is a key contributor to NextGen</p> <p>Member of RTCA NextGen Advisory Committee</p> <p>Key technology provider for ADS-B program</p> <p>Enabling data comm with Thales automation platform</p> <p>Providing analysis work with the areas of safety and security</p> <p>ICAO ASBUs</p> <p>All Thales solutions are compliant with Block 0, and on the way to meet Block 1 requirements. Thales has the knowledge and expertise in the ASBUs together with the largest worldwide ATM installed base to advise our users about implementing them wherever they are.</p>
Entity Profile matching the task	<p>THALES AIR SYS will provide relevant profiles and its expertise for the project development in the following domains:</p> <ul style="list-style-type: none"> • ATM systems • System engineering • Technical Architecture • Software development team for R&D • Platform development • Platform integration and validation
Contribution	<p>THALES AIR SYS will participate to the project coordination.</p> <p>THALES AIR SYS will contribute to the development of the concept elements of the solution 04, analyse and review operational requirements to evaluate the impacts of the concept elements on the ATC systems, contribute to the development of the technical requirements.</p> <p>THALES AIR SYS will develop ATC ground prototypes to support the enhanced concept of operations for solution 04, integrate the prototypes on targeted validation platforms and sustain them during the RTS validation activities.</p> <p>THALES AIR SYS will contribute to the solutions P17 and 21 with the involvement of its LTPs EDISOFT, NAV Portugal and Searidge Technologies. EDISOFT will develop ATC ground prototypes to support the validations of Solution 17 and Solution 21. THALES AIR SYS will also provide enhanced simulator to support the RTS validation activities for these solutions.</p>

4.1.1.34 THALES AVS FRANCE SAS

Organisation	19 THALES Avionics	Airborne Industry
Description	<p>THALES AVS FRANCE SAS (short name THALES Avionics) is one of the leading global suppliers of avionic solutions for the commercial and military aerospace markets. The company offers a wide range of functions and on-board electronic equipment for fixed wing and rotary wing aircraft. It provides its customers with all equipment, subsystems and systems in the areas of flight management, navigation, communication and surveillance.</p>	

	<p>In the civilian area, its solutions address both helicopters and commercial aircraft and regional and business aircraft. Clients include AIRBUS, ATR, Boeing, Bombardier, Embraer, Eurocopter, Gulfstream, Sikorsky and Sukhoi, to name but a few.</p> <p>THALES AVS FRANCE SAS' product lines range from the provision of complete avionics suites to cockpit and head-up displays, flight management, flight guidance and flight control equipment, communication, navigation and surveillance systems, integrated modular avionics and integrated maintenance.</p> <p>Growing aircraft numbers make air traffic management more complex. THALES AVS FRANCE SAS solutions help to make the end-to-end system operations safer and more efficient. Expert on airborne real-time critical systems, and leader of major European projects shaping the future of aerospace operations, THALES AVS FRANCE SAS is a key player in the definition of industry standards and in bringing to market innovative solutions.</p> <p>THALES AVS FRANCE SAS is a key partner for the R&D contributing to the definition and validation of the ATM operational improvements. It is fully involved in worldwide standardisation activities essential for European and worldwide ATM interoperability; inter alia ICAO, support to SES regulation, EUROCAE/RTCA, ARINC, EASA CNS/ATM, ASAS RFG and AEEC.</p> <p>THALES AVS FRANCE SAS is also a key participant in the Clean Sky JTI programme and as a result, will contribute to coordinating SESAR with Clean Sky to bring the best value for money.</p> <p>Regarding involvement in PJ02, THALES AVS FRANCE SAS has a particular expertise for the definition and provision of avionics supporting GBAS or SBAS intended navigation capabilities, mainly</p> <ul style="list-style-type: none"> • GBAS/SBAS GNSS receivers, • Air data systems, • Flight Management systems supporting RNP navigation and GNSS approach operations: LNAV/VNAV, LPV, GLS, • Autoflight and control systems providing automatic guidance during RNAV/RNP and XLS precision approach. <p>Interface devices (Displays and RMP/FCU) providing the crew with avionics system control and operation performance monitoring capabilities.</p> <p>In addition THALES AVS FRANCE SAS has a strong experience in Low Visibility Operations as a HUD and Synthetic Vision System supplier.</p>
Previous experience	<p>THALES AVS FRANCE SAS has been involved for many years in a number of European research programs aiming at the definition of GNSS based navigation capabilities supporting approach and landing.</p> <p>Previous projects:</p> <ul style="list-style-type: none"> - SESAR 1: THALES AVS FRANCE SAS has led WP 9.9 (LPV), WP 9.10 (RNP2XLS), WP9.27 (GPS/GALILEO), and contributed in WP9.12 (GBAS CATII/III), WP 6.8.5 (GBAS procedures), WP 6.8.8 (Advanced GBAS procedures) - SESAR 2020 Wave-1 (PJ.02): • Within PJ02-02 Enhanced Arrival Procedures Solution, THALES AVS FRANCE SAS contributed to the characterization and definition of the potential impact or modification in the avionics required for the implementation of the new operations.

	<ul style="list-style-type: none"> • Within PJ02-11, Enhanced Terminal Area for efficient curved operations, THALES AVS FRANCE SAS contributed to the characterisation and the definition of the concept implying on-board use of combined vertical and horizontal complex navigation based on baro and GNSS sensors within TMA and final approach. - OPTIMAL (FP6, 2007-2009): (Contributor) : Optimized Procedures and Techniques for Improvement of Approach and Landing - GAGARIN (FP7, 2009): (Leader) The objective of the GAGARIN projects were to assess operational potential benefits of a GALILEO/GLONASS receiver, compared to existing GPS receiver and to baseline GALILEO/GPS receiver. - GARMIS (FP7, 2005), STANDARD (FP7, 2008), JASMIN (FP7, 2012), ATLAS (GSA, 2016): (Contributor): The purpose of these projects was to carry on the EGNOS and Galileo standardisation process already started in aviation, maritime and location based services
Entity Profile matching the task	<p>THALES AVS FRANCE SAS is one of the few companies to innovate throughout the full operational chain of aerospace activities. It covers a wide range of on-board electronic equipment and functions. The company is active in a number of research areas:</p> <ul style="list-style-type: none"> • Human factors and display • Real-time processing and embedded middleware • Navigation, communication and surveillance • System and software engineering <p>THALES AVS FRANCE SAS will support the project with staff knowledge and capabilities in:</p> <ul style="list-style-type: none"> • Research analysts experienced in navigation function and in enhanced visual operations • R&D concept development, including operational expertise • Software and system engineering expertise to support the integration of developed building blocks into simulation facilities. • Validation and verification expertise • Standardization experience <p>THALES AVS FRANCE SAS will support the project with means :</p> <ul style="list-style-type: none"> • Avionics validation benches
Contribution	<p>THALES AVS FRANCE SAS will contribute by bringing its expertise and knowledge in:</p> <ul style="list-style-type: none"> - Sol. 4: Enhanced Terminal Area for efficient curved operations, by studying advanced geometric GNSS based procedures - Sol.17: Improved access to secondary airports, by studying and simulating new SVGS procedures to extend the current SVGS approach potential to LPV approaches.

4.1.2 Main profiles/CV (they may be the same person for more than one role)

4.1.1.35 Project Manager: Vincent Treve

Vincent Treve is the Runway Throughput Programme Manager at EUROCONTROL, including RECAT-EU and Time-Based Separation (TBS) projects. He has an aeronautical engineering background and was the EUROCONTROL representative in the joined International working groups (AIRBUS – EUROCONTROL – EASA – FAA) called by ICAO for designing the A380 Wake turbulence separation, and for assessing the potential needs of special guidance for the B747-8 wake turbulence separation. He also developed and conducted the Paris CDG WIDAO project.

4.1.1.36 Solution Leaders

4.1.1.36.1 Solution 04: Anette Näs

Mrs. Anette Näs is an aeronautical engineer who has worked in aviation for almost 20 years. She was a researcher at the Swedish Defense Research Agency for 13 years, mainly as a project manager and task leader for national and European projects in the areas of aviation environmental research and new aircraft concept research. Anette started working for Stockholm Arlanda Airport ten years ago as a Manager for Swedavia's application for a new environmental permit for Stockholm Arlanda Airport. The main focus area was airspace and aircraft operational procedures in the Terminal Area including PBN implementation issues as well as capacity issues. Anette is now working in the ATM Department of Swedavia as Senior Project Leader and ATM/Airport Operations Expert. She has been involved in projects linked to time based operations, enhancement of arrival and departure flows, strategic development of airport capacity and steeper approaches using e.g. GBAS. Anette has been involved in several collaborative projects between airlines, LFV, Stockholm Arlanda Airport for future operational concepts. She has also been involved as a contributor to SESAR 1 Projects 5.7.2 and 6.6.8, SESAR 2020 Wave 1 PJ 02-11 and is managing the SESAR Deployment project SAARP – Stockholm Arlanda Airspace Redesign Program.

4.1.1.36.2 Solution 14: Valerio Cappellazzo

Valerio Cappellazzo holds a Master Degree in Automation and Management Engineering (2010) from Roma Tre University. He has 9 years of professional experience, 7 in the field of ATM and civil aviation. He works in the EUROCONTROL Airport Research Unit as Wake Expert coordinating the EUROCONTROL contribution to the SESAR2020 PJ02.01 Solution ‘Wake turbulence separation optimization’ where new wake concepts and runway throughput enhancement solutions are developed, tested and validated with the collaboration of industrial partners and air navigation service providers. He also follows SESAR Deployment projects on TBS with DSN and Charles De Gaulle Airport.

4.1.1.36.3 Solution 17: Karel Houdek

Project manager experienced in leading cross-functional project teams in international tech company. Before current Project Manager role, Karel worked as Mechanical Design Engineer for 10 years. Karel Houdek was graduated in 2015 from the Faculty of Mechanical Engineering of Brno University of Technology.

4.1.1.36.4 Solution 21: Claudio Vaccaro

Claudio Vaccaro was awarded a full master degree in Nautical Sciences (1993) at “Istituto Universitario Navale” (today Parthenope University) – Naples (Italy), developing an experimental thesis in Flight Mechanics. Principal subjects of study were Flight Mechanics, Navigation, Radar Systems and NavAids, Air Traffic Management, Electromagnetic fields and Propagation of electromagnetic waves.

After a couple of years teaching Air Traffic Control at one of the most relevant Institution in Italy (Istituto Aeronautico De Pinedo, Roma), he joined SICTA in 1997 to take the role of Team Leader for the EU Project SEEDS (Simulation Environment for the Evaluation of Distributed traffic control System), leading experimental operational procedures design for the A-SMGCS implementation at Rome Fiumicino and Milan Malpensa airports. In the following years, Claudio had been SICTA Project Manager/Team Leader for a number of EU projects (ISAM, Sourdine, Leonardo, RESET, Gate-to-Gate, EMMA, etc.) investigating on airports topics. With specific reference to SESAR, he had been involved into the SESAR Programme since the early Definition Phase as SICTA Team Leader in the “Research Consortium RCT”. In the later SESAR

Development phase (SESAR-1) he had been the Project Coordinator of the P05.09 *Usability Requirements and Human Factors Aspects for the Controller Working Position*. Finally, in the SESAR2020 Wave 1 he has been the PJ03a Project Coordinator and PJ03a.01 Solution Leader.

From January 1st 2019 he has joined the Project Management Office unit of Techno Sky (ENAV Group).

4.1.1.36.5 Solution 25: Jaroslaw Niewinski

Jaroslaw Niewinski has attended Gdynia Maritime University and Cork Institute of Technology with principal study field of Business Management.

Jaroslaw's experience includes large scale projects outside aviation field (introduction of cable and satellite internet, business start-ups in tourism and hospitality area) as well as in aviation, where he served as a tower ATC officer (Warsaw Airport), followed by various expert and managerial roles, including current – Head of Innovations at PANSO. His expertise is focused on aviation business and airport airside development, he was leading consultant for operational excellence and business transformation and efficiency for airports, air navigation services providers and handlings.

Among others, Jaroslaw's R&D most important works include Airside Capacity Enhancement, use of mathematical modelling for runway conditions prediction at airports, data management systems for Tower, runway safety nets and alternative ground surveillance system, where he delivered operational context, supported by safety and human factors expertise. He is directly involved in the activities enabling enhanced accessibility into secondary airport, including topics based on applicability of GNSS-based navigation.

Jaroslaw has been actively participating in the SESAR2020 PJ.03b and PJ.02 projects and leads the SESAR2020 PJ.02-06 solution.

4.1.1.37 PCIT Leader: Anthony Inard

Anthony Inard is graduated in Air Traffic Control and Computer Science by the French Academy for the Civil Aviation (ENAC Toulouse). He has over 25 years' experience in the aviation field and 21 years' experience in EUROCONTROL. Anthony fulfilled the function of PCIL Leader for PJ02 and PJ04 in SESAR 2020 Wave1. In this role, Anthony supported the Project Coordinator in the full engagement of the PJ with the transversal projects (PJ19/20/22). He managed the PJ02 and PJ04 PCITs, promoted the use of MEGA (EATMA) and SE-DMF across the projects and organised various forms of support to secure modelling achievements. Anthony was also involved in PJ19 in full support of the Change Request management for the European ATM Master Plan release lifecycle.

4.2 Third parties involved in the project (including use of third party resources)

4.2.1 Linked to EUROCONTROL – European Organisation for the safety of Air Navigation - EUROCONTROL

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>Flight simulator preparation for cockpit related evaluations. EUROCONTROL will take care of the organisation of cockpit simulations, the preparation of the procedures, the execution of the simulations and post data analysis. The provision of the simulation platform(s) will be subcontracted. (795keur)</p> <p>Development related to simulations will be contracted (430keur)</p> <p>Data architecture, BD/ML and data mining analysis will be subcontracted (1925keur)</p> <p>LiDAR operation and maintenance will be subcontracted (100keur)</p> <p>Validation support will be subcontracted (550keur)</p> <p>Administrative support will be subcontracted (350keur)</p> <p>Communication (50keur)</p>	

Does the participant envisage that part of its work is performed by linked third parties	N
N.A.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N.A.	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
N.A.	

4.2.2 Linked to AIRBUS SAS

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>Airbus Operations SAS will subcontract part of its contribution. The activities subcontracted in the framework of PJ02 will consist of support to AI OPS for design and test of avionics equipment.</p> <p>The subcontracted part of the activities is in full consistency with the “make or buy” policy applicable at Airbus Operations SAS ensuring that core activities and expertise is kept internally and respecting H2020 rules as well as any relevant legislation with regards to subcontracting. In particular, AI OPS representative will be internal staff. The subcontractors will be selected after competitive calls for tender and relevant selection processes ensuring the best value for money or, if appropriate, the lowest price and avoiding any conflict of interests. These subcontracting agreements are not placed only for SESAR tasks although they include specific work packages for SESAR and are renegotiated on a periodic basis. AI OPS will however check and ensure the consistency of the existing subcontracting agreement with the H2020 requirements.</p> <p>For instance, it is foreseen that: Aeroconseil/AKKA and ALTRAN will provide support to operate laboratory means and on aircraft performance topics, Alten will provide support to cockpit operations design, EGIS AVIA will provide support with regard to Human factors aspects, SII will provide support to evaluations, Cimpa will provide support for AirTop simulations, and Assystem will provide support to test integration and installation.</p> <p>The subcontracting of Aeroconseil/AKKA, ALTRAN and EGIS AVIA is estimated to 662,000.00 € euro</p> <p>Nevertheless, a new selection is likely to happen during the Grant development, as per the AI OPS policy to permanently ensure the best value for money.</p>	
Does the participant envisage that part of its work is performed by linked third parties	Y
<p>For the present proposal, Airbus Operations SAS is linked third parties of Airbus SAS, as declared in the Airbus Proposal for Membership Accession -REF. SJU/LC/0122-CFP.</p> <p><i>Airbus Operations SAS</i></p> <p>Airbus Operations SAS designs and manufactures aircraft, aircraft parts, systems, equipment and derivative products, and also provides services in the field of aeronautics. Airbus Operations SAS</p>	

Engineering is operated in one major design office in Toulouse. It gathers top-level competencies such as integrator architecture, general design, integration tests and systems, propulsion, structural design and computation.

The Toulouse Design Office has dealt with systems design and development for many years and acquired a large expertise in this area.

The effort of the Beneficiary Airbus SAS is below the effort of its Linked Third Party Airbus Operations SAS for PJ02. This results from the structure of the company splitted in various legal entities, where the management of Commercial Aircraft Division is handled by Airbus SAS while Airbus Operations SAS hosts the Centre of Competence dealing with ATM systems design.

Airbus Operations will support Airbus SAS as the contributor to SESAR 2020 PJ02 Solution #14 in the development and validation of Runway Occupancy Time prediction models and in the understanding of current Runway Occupancy Time through in-service data analyses. Airbus Operations will also support Airbus SAS on the concept of operations related to delegation of separation.

Airbus SAS will ensure the overall coordination and provide the capabilities in terms of Fast Time Simulation (AirTop), Airport operations and Cockpit operations.

Airbus Operations will support Airbus SAS as the contributor to SESAR 2020 PJ02 Solution #17. Airbus SAS will ensure the overall coordination of the Validation performed in PANSA environment and associated communication. Airbus Operations will handle technical contribution for the EFVS including Validation activities.

Airbus SAS will ensure the overall coordination for Airbus contribution of SESAR 2020 PJ02 Solution #25, the coordination with Airlines and communication. Airbus Operations will handle technical contribution related to the new version of OBACS specification and prototyping to validate computer vision.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
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N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
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N.A.

4.2.3 Linked to RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK - ANS CR (B4)

No third parties involved

4.2.4 Linked to LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK - LPS SR (B4)

No third parties involved

4.2.5 Linked to VALSTYBES IMONE ORO NAVIGACIJA - ON (B4)

No third parties involved

4.2.6 Linked to POLSKA AGENCJA ZEGLUGI POWIETRZNEJ - PANSA (B4)

Objective

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N.A.	
Does the participant envisage that part of its work is performed by linked third parties	Y/N
<p>Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw (ICM) (short name UNIWARSAW)</p> <p>PANSA Linked Third Party ICM is an interdisciplinary unit that is a part to the University of Warsaw. ICM possesses a documented experience in participating in airport centred projects (in collaboration with Polish Airports) as well as working on interface of airport and network planning (in collaboration with Polish Ministry of Transportation and Lot Polish Airlines). ICM has expertise in providing solutions and efficiently modelling of high complexity networks as well as processing large datasets of varying nature.</p> <p>Besides experience and expertise ICM possesses a reliable and secure HPC and big data processing centre. ICM R&D activities are focused on (but not limited to) big data exploitation and processing, algorithms design and optimization, environmental modelling and weather based applications, applied network modelling and complex process modelling (e.g. in transportation, energy industry, society health management). ICM operational services include: provision of HPC infrastructure, WBN - virtual opens source science library, RepOD - scientific data repository and numerical weather prediction service.</p> <p>The combining of in-house computational infrastructure and interdisciplinary expertise allows ICM UW to successfully participate in national and international research projects (including EU framework programmes FP4 -HORIZON 2020). Among them are also numerous projects focused on aviation, including:</p> <p>SESAR 2020 Wave 1 projects within the PJ.02-W2 scope:</p> <ul style="list-style-type: none"> ▪ SESAR 2020 Wave 1 PJ.02 EARTH, WP06: "Traffic optimisation on single and multiple runway airports", ▪ SESAR 2020 Wave 1 PJ.03b SAFE, WP05: "Safety support tools for runway excursions", <p>as well as other projects:</p> <ul style="list-style-type: none"> • Airline operations and analysis DSS System for Polish Airlines LOT. • Cause-incident safety occurrence drill-down chain concept developed for Polish CAA. • Airport Seasonal Wind Rose developed for Polish Air Navigation Service Provider. • Development strategy for the network of airports and aviation ground nav aids - for Polish Ministry of Infrastructure. • SID/STAR Flight profiles performance evaluation - for Polish Air Navigation Service Provider. • Resilience of airport resources operational planning - study dedicated for Warsaw Chopin Airport. <p>FP7 DELICAT project focused on clear-air turbulence detection with THALES, DLR, EADS, Meteo France and others.</p> <p>ICM will support PANSA as the contributor to SESAR 2020 Solution #25 in further development of Runway Condition Code Prediction Engine started as part of the Wave 1 SESAR 2020 Solution PJ.03b-06 with the Project PJ.03b SAFE. ICM will contribute to the following Tasks under SESAR 2020 Solution #25 in the scope of Runway Condition Code Prediction Engine development:</p> <ul style="list-style-type: none"> • T25.02 - PJ.02-25 Concept Description (V3) • T25.03 - PJ.02-25 Technical Specification (V3) • T25.04 - PJ.02-25 VALP (V3) • T25.05 - PJ.02-25 Prototype Development (V3) • T25.06.1 - PJ.02-25 Exercise 1 	

- T25.06.2 - PJ.02-25 Exercise 2
- T25.07 - PJ.02-25 Validation Report (V3)
- T25.08 - PJ.02-25 CBA (V3)

WASKO S.A.

PANSA Linked Third Party WASKO S.A. is one of the leading Polish IT&T companies. In the last 4 years WASKO S.A. completed four major projects co-financed from EU funds and 16 research and development projects; in addition to various commercial and aviation infrastructure oriented projects. For their implementation, WASKO S.A. cooperates with renowned National Research and Development units of Higher Education. Cooperation, in a vast majority, has been performed on the basis of multi-annual framework agreements concluded, defining the framework and the principles of cooperation. WASKO S.A. has experience with projects related to the creation of decision support systems and system integration, development schemes workflow and logistics. WASKO S.A. has a team of analysts and solution designers for decision support systems, as well as facilities to create solutions for these systems. Below are listed only some of Wasko's projects:

- "New generation of on-board equipment, enhancing the survival of military land vehicles" Date: 2008.10.01. – 2010.11.30. Managing Authority: Ministry of Science and Higher Education.
- "Autonomous universal platform to track and combat logistics tasks according to the standards of a modern battlefield" Date: 2008.10.07. – 2011.01.06. Managing Authority: Ministry of Science and Higher Education.
- "IP Encryptor - implementation of a cryptographic system based on innovative semiconductor technologies" Date: 2008.12.08. – 2010.12.07. Managing Authority: Ministry of Science and Higher Education.
- "Cryptographic co-processor generator technology demonstrator operating on the elements of the body GF2N" Date: 2009.06.29. – 2011.06.29. Managing Authority: Ministry of Science and Higher Education.
- "Design and technology demonstrator of support system for operational and procedural activities for country defence and security" Date: 2009.07.10. – 2011.01.09. Managing Authority: Ministry of Science and Higher Education.
- "Demonstrator measurement technology object orientation in space and distributed embedded system designed for autonomous control of manned and unmanned platforms battlefield" Date: 2009.12.16. – 2010.12.15. Managing Authority: Ministry of Science and Higher Education.
- "Construction of the platform of software and hardware for an integrated information communication system in urban areas" Date: 2010-04-01. - 2012-03-31. Managing Authority: National Centre for Research and Development.

WASKO S.A will support PANSA as the contributor to SESAR 2020 Solution #21 in further development of Vehicule Tracking System based on GPS started as a part of the Wave 1 SESAR 2020 Solution PJ.02-06 within the Project PJ.02 EARTH. WASKO S.A. will contribute to the following Tasks under SESAR 2020 Solution #17 in the scope of Vehicule Tracking System development:

- T17.3.02 - PJ.02-17 Concept Description (V3)
- T17.3.03 - PJ.02-17 Technical Specification (V3)
- T17.3.04 - PJ.02-17 VALP (V3)
- T17.3.05 - PJ.02-17 Prototype Development (V3)
- T17.3.06.1 - PJ.02-17 Exercise 1
- T17.3.07 - PJ.02-17 Validation Report (V3)
- T17.3.08 - PJ.02-17 CBA (V3)

MicroStep-MIS spol. s r.o. (short name MicroStep-MIS)

MicroStep-MIS is a private limited liability company specialized in development, production and marketing of monitoring and information systems, processing of measured data and numerical modelling with more than 25 years of experience.

The company's key fields of activity include meteorology and climatology, aviation systems, road weather information systems, hydrology and marine systems, radiation monitoring systems,

seismology, air quality and emission monitoring, crisis management systems, flood warnings, fire forest protection, and system integration.

MicroStep-MIS operates worldwide and it offers its core customer groups – stakeholders ranging from airports, meteorological and seismological institutes, environmental authorities, to industry and municipalities – a number of aviation monitoring systems, including IMS4 AWOS, IMS4 AWOS LITE, IMS4 Wind System, IMS4 RVR, IMS4 ARWIS, IMS4 Pilot Briefing, IMS4 LLWAS, IMS4 ATIS/VOLMET, IMS4 Aeronautical Climatological Database, IMS4 AWDSS, Regional weather prediction model, Radar based thunderstorm nowcasting, Fog prediction model, Integrated Glide Slope Area Monitoring System for all weather conditions.

Since December 2012, the company has been also a certified Air Navigation Service Provider of meteorological observations and reports (METAR/SPECI), forecasts (TAF), aeronautical climatological information and service for operators and flight crew members (Briefing). In 2014 company got the certificate of Competency to Perform Research and Development.

MicroStep-MIS will support PANSA as the contributor to SESAR 2020 Solution #25 in further development of system capable of monitoring and forecast runway conditions and reporting of outputs in Global Reporting Format. MicroStep-MIS will contribute to the following Tasks under SESAR 2020 Solution #25 in the scope of Runway Condition Code Prediction Engine development:

- T25.02 - PJ.02-25 Concept Description (V3)
- T25.03 - PJ.02-25 Technical Specification (V3)
- T25.04 - PJ.02-25 VALP (V3)
- T25.05 - PJ.02-25 Prototype Development (V3)
- T25.06.1 - PJ.02-25 Exercise 1
- T25.06.2 - PJ.02-25 Exercise 2
- T25.07 - PJ.02-25 Validation Report (V3)
- T25.08 - PJ.02-25 CBA (V3)

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)

Y

PANSA will use in-kind contributions provided by third parties, Gdansk Lech Walesa Airport, which is validation platform for concepts developed by PANSA within the Solution #17 and Solution #25.

For the purpose of prototype testing and validations of Alternative Ground Surveillance, dynamic Runway Occupancy Time model and Vehicle Tracking System, developed by PANSA and its LTPs as part of Solution #17 and Solution #25, Gdansk Lech Walesa Airport will secure PANSA access to airport locations for system component installation, airport data to feed the AGS, performance of the day-to-day operational duties with validation equipment installed and access to airport-related runway data collected by Boschung Ice Alert system.

This contribution corresponds to the one referred to in Art. 11 of the General Model Grant Agreement (in-kind contributions against payment) and currently is estimated to amount to around 96.6k € (direct costs) and it is identified in Annex 2 in the column “Costs of in-kind contributions not used on premises”.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?

N

N.A.

4.2.7 Linked to AUSTROCONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH - ACG /COOPANS

No third parties involved

4.2.8 Linked to CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD - CCL /COOPANS

No third parties involved

4.2.9 Linked to UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY - IAA /COOPANS

No third parties involved

4.2.10 Linked to LUFTFARTSVERKET - LFV /COOPANS

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N.A.	
Does the participant envisage that part of its work is performed by linked third parties	N
N.A.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N.A.	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
N.A.	

4.2.11 Linked to Naviair - Naviair /COOPANS

No third parties involved

4.2.12 Linked to DASSAULT AVIATION - DASSAULT

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>Solution 25: DASSAULT AVIATION intends to subcontract the wiring tasks. The wiring tasks need dedicated knowledge that DASSAULT AVIATION does not have internally. The subcontractor will be LABINAL company. DASSAULT AVIATION and this company, which is the only one having some facilities in the area of the flight test centre, have developed over the years common processes and qualification methodologies enabling an efficient work together. (3000EUR)</p> <p>Solution 17: DASSAULT AVIATION intends to subcontract to OKTAL-SE a task in order to improve the simulation tool which will be used to mature the advanced CVS concept. OKTAL-SE is already a provider for this simulation tool. (54.000EUR)</p>	

Does the participant envisage that part of its work is performed by linked third parties	N
N.A.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N.A.	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
N.A.	

4.2.13 **Linked to DFS DEUTSCHE FLUGSICHERUNG GMBH - DFS**

No third parties involved

4.2.14 **Linked to ENTIDAD PUBLICA EMPRESARIAL ENAIRE - ENAIRE**

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
ENAIRE plans to subcontract the involvement of pseudo-pilots in those validation activities to be executed in ENAIRE premises.(37.280€)	
Does the participant envisage that part of its work is performed by linked third parties	Y
<p><u>CRIDA</u></p> <p>CRIDA A.I.E. (Reference Centre for Research, Development and Innovation in ATM) is a non-profit joint venture between ENAIRE, The Polytechnic University of Madrid and Ineco. CRIDA's mission is to improve the performance of the Spanish ATM management system. As an integral part of the global system, CRIDA intends to increase the safety, capacity, environmental and economic impact of ATM through ideas and R&D+i projects. CRIDA's investigative priorities revolve around three main lines in which CRIDA leverages its proven experience and solid international reputation:</p> <ul style="list-style-type: none"> • System monitoring and diagnostics to identify problems and their causes. This continuous system observation is realized through systematic performance quantification; • Analysis and validation of R&D+i solutions, viability studies and quantification of the benefits in terms of system performance improvements; • Collaboration in the development and subsequent deployment of those solution alternatives that provide the best system benefit. <p>CRIDA will contribute to solution PJ.02-14 and PJ.02-21. In Solution #14, CRIDA will provide support to concept development and procedure design and, in Solution #21, CRIDA will provide support to the validation activity lead by ENAIRE.</p>	

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	Y
<p>Several companies have been collaborating by means of third party in kind contribution with ENAIRE for long time, and a close collaboration exists in this sense. This has been the habitual practice in SESAR1 and in SESAR 2020 Wave 1 activities and the results have become optimal in terms of efficiency and mutual collaboration.</p> <p>The use of this in kind contribution is identified as a key factor for the proper development of the activities under this project. The complementarity of the know-how and expertise profile obtained by this form of collaboration is necessary to achieve the targets with the expected level of quality.</p> <p>This contribution corresponds to the one referred to in Art. 11 of the AMGA (in-kind contributions against payment), in turn corresponding to category "A.3- seconded persons" of the Annex 2 of the Grant Agreement, and currently is estimated to amount to around 69.200 € (direct costs) for the work developed on ENAIRE's premises (since there is no specific place in Annex 2 to indicate these costs).</p>	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
N.A.	

4.2.15 Linked to ENAV SPA - ENAV

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N.A.	
Does the participant envisage that part of its work is performed by linked third parties	Y
<p>ENAV contribution in the project is complemented by the following LTPs: Techno Sky, NAIS, IDS AIRNAV and NAV CANADA.</p> <p>Techno Sky</p> <p>Techno Sky S.r.l. (Techno Sky) is an ENAV Group Company having the responsibility for the management and maintenance of systems and equipment used for Air Navigation Services in Italy as well as for the support to the ATM operational innovation and for all the relevant ENAV Group R&D activities.</p> <p>As Enav's mission critical systems integrator, Techno Sky controls the full value chain, i.e. Research and Development, System Engineering, Design, ATM Software Development, Weather System Development,</p> <p>Verification, Validation, Installation, Integration, Training, Logistics and Maintenance.</p> <p>In 2017 Techno Sky extended its background of knowledge and expertise on R&D following the transfer of competences and experts coming from SICTA, the former ATM R&D branch of ENAV Group.</p> <p>The acquisition of ATM R&D experts is showing the Techno Sky constant commitment and focus on technological innovation, as a key factor for its continuous improvement and increased competitiveness on the market.</p>	

In addition, by investing in the study and implementation of new and more effective products and applications, Techno Sky acts significantly within the value chain of the ENAV Group and contributes to the efficiency, regularity and safety of Air Traffic Management operations.

Special care is devoted to the study of innovative systems to be used in the Company's core business. These studies and surveys are intended to improve innovative operational services supported by several simulators, platforms, tools and advanced methodologies.

Techno Sky, working in close cooperation with ENAV, has also gained an outstanding expertise in the development of innovative Air Traffic Management operations, in the development and validation of new concepts and procedures for the continuous improvement of performances, in assisting the supply industry to design and engineer new systems to safely support the Air Traffic Controllers in their highly demanding tasks.

Techno Sky, as ENAV Linked Third Party, is involved in ENAV ATM strategic planning, technical co-operation and service provision programs with international organizations (e.g. SESAR Joint Undertaking, SESAR Deployment Manager, EUROCONTROL, European Commission, etc.) and foreign countries, aiming at contributing to the advancement of ATM technology and processes and at improving all the linked services.

Techno Sky participation is quite significant from an ENAV perspective considering it brings an important piece of transversal technical, operational and management expertise.

Moreover, Techno Sky is currently extensively contributing to SESAR 2020 Wave 1 Programme as ENAV LTP by complementing ENAV activities and expertise in 14 W1 projects including Industrial Research, Transversal activities and Very Large Demonstrations.

Based on the considerations and skills depicted above, ENAV and Techno Sky, as part of the ENAV Group, can be considered as a single entity.

Techno Sky contribution to this project is intended to be provided in all activities where ENAV has expressed interest, with special emphasis on the operational validation of the concepts developed within the project solutions. Specifically, transversal contribution to the tasks for the concept, procedures and requirements definition; for structuring and organising all validation activities as well as for executing and reporting results of the validation exercises envisaged to be performed within this project.

NAIS

Established at the end of 2006, NEXTANT Applications & Innovative Solutions (NAIS) is an Italian, private- owned, ICT Company, classified as SME according to the European Commission classification (2003/361/EC). The company's mission is to develop and propose, to the proper market sectors, innovative applications and services based on ICT technologies and Satellite Navigation, EO & Communication assets.

NAIS' main expertise in the Space & Defence market domains plays a strategic role in the development of innovative application based on ICT and enabling satellite technologies. NAIS executes the whole Technology Transfer Process from R&D Projects to product industrialization and commercialization

NAIS is based in Rome, and its HQ hosts the following facilities: R&D centre, 2° level Helpdesk, Customer support team, product & service provisioning team. Its Quality System is certified ISO 9001:2008. It operates in the following business segments: Space & Defence, Transport/Maritime, Information & Communication Technology, Aeronautical.

Innovative applications and services are available in the field of Smart-mobility (solution for both citizens and tourists, transportation support and information), Emergency (mission management and resource planning), Cultural Heritage (safeguard, fruition and prevention), Maritime (search & rescue, mission management and access to harbour and docks), Defence (air defence systems radar), and Aeronautics (Air Traffic Management systems, conventional and unconventional 2D & 3D operational displays, flight information systems and portable flight displays for VFR General Aviation aircraft), all based on Satellite technologies (Navigation (EGNOS/GALILEO), Communication, and

Earth Observation), innovative HMI techniques based on Virtual and Augmented Reality techniques and Engineering / architectural aspects.

In addition, NAIS is currently participating in SESAR 2020 Wave 1 as ENAV LTP and is supporting with its technical and management expertise the ENAV work in W1 projects PJ01, PJ02, PJ03a, PJ05 and PJ16, with special focus on validation activities and KPA assessment.

NAIS will contribute to ENAV work in WP06 by supporting ENAV in the technical developments and in the conduction of the proposed validation activity, with special focus on KPA assessment.

IDS AIRNAV SRL

IDS AIRNAV SRL (IDS AIRNAV) is the company of the ENAV Group that serves the world of Air Traffic Management (ATM) and airports with Commercial Off-The-Shelf (COTS) solutions and software products aimed at supporting the transition from Aeronautical Information Services (AIS) to Aeronautical Information Management (AIM) in full compliancy with the ICAO and EUROCONTROL mandates for Aeronautical Data Quality (ADQ).

Developed in close partnership with its customers, and continually supported and updated to adapt to changing and more stringent requirements, IDS AIRNAV portfolio now comprises a comprehensive ADQ compliant solution for Aeronautical Information Management (AIM), which can cover the whole process from data collection to publication as well as a system for Air Traffic Flow Management (ATFM) and collaborative decision making (CDM).

IDS AIRNAV network of services and support teams provide assistance for its solutions, consultancy and a wide range of professional services. These include ICAO recognized flight procedure design services along with ground-based validation, flyability evaluations, R&D activities, risk assessments and mitigation recommendations. Amongst other tailored services IDS AIRNAV can also provide communication, navigation and surveillance (CNS) performance evaluation, NAVAID siting analysis and electromagnetic interference evaluation, as well as terrain and obstacle acquisition and chart design.

IDS AIRNAV, an high tech integrated solutions services company, is now recognised as a leading solution provider to Air Navigation Service Providers, Airports Authorities, aviation agencies, Government and private entities that manage Air Traffic in both the civil and military markets.

In line with the ENAV Group work in W1 on airport domain, IDS AIRNAV will support ENAV in the TWR Simulator developments required to execute the ENAV validation activity in WP06.

NAV CANADA

NAV CANADA is the worlds' second largest ANSP with the responsibility to provide ANS to over 19 million km² of domestic airspace handling over 12 million aircrafts movements each year. Much of the vast area that has to be managed is remote, sparsely populated and has limited infrastructure.

NAV CANADA has a long term program to evaluate and install advanced technology to improve Air Navigation Service (ANS) performance and efficiency. To this end we have invested over \$2B in new technology, including remote services, since 1996 when NAV CANADA first took over operation of domestic ANS.

NAV CANADA provides ATS at the following domestic facilities:

- 7 Area Control Centres (ACC), 1 for each Flight Information Region (FIR) across 5 time zones
- 41 Control Towers
- 56 Flight Service Stations (FSS)
- 8 Flight Information Centres (FIC)
- 51 Community Aerodrome Reporting Services (CARS)

In addition:

- Remote Advisory Service (RAAS) is provided from 23 of 56 FSS to 38 aerodromes (see figure aside)
- Automated Weather Observation & Reporting (AWOS) supply remote observations
 - 77 AWOS (Automated Weather Information System)
 - 5 LWIS (Limited Weather Information System)
 - 148 Weather Cameras

NAV CANADA has supported SESAR related activities on tower operations with ENAV and enroute/oceanic operations with NATS.

NAV CANADA is linked to ENAV through the sharing of a strategic plan for cooperation in several ATM related domains. Such plans include joint and coordinated efforts to be injected in SESAR to foster the development of specific key features of the SESAR 2020 Programme. ENAV and NAV CANADA have also a well-established commercial partnership in AIREON, a U.S. Company for the provision of global satellite-based surveillance.

Specifically, in the airport domain, NAV CANADA is supporting ENAV in the national deployment project on TWR architecture renewal, where NAV CANADA is providing the new TWR suite. Within the SESAR R&D framework, NAV CANADA successfully participated with ENAV in the SESAR 1 Large Scale Demonstration project RACOON (2014-2016) and is currently supporting ENAV work, as ENAV LTP, in SESAR 2020 Wave 1 project PJ05 “Remote Tower”.

Following these collaborations on the new TWR suite, NAV CANADA will support the ENAV activity in WP06 by further evolving the TWR suite according to the required solution developments.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
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N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
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N.A.

4.2.16 **Linked to ATOS BELGIUM - ATOS (FSP)**

No third parties involved

4.2.17 **Linked to FREQUENTIS AG - FRQ (FSP)**

No third parties involved

4.2.18 **Linked to HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN - HC (FSP)**

Objective

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
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Deep Blue Srl – Safety and Human Factors consultant

HC (FSP) will subcontract part of their contribution to Deep Blue Srl. Deep Blue is an R&D company that carries out research projects and consultancy services in the areas of Safety, Security and Human Performance. HC (FSP) subcontracts part of the Safety and Human Factor tasks regarding the validation exercise. The consultancy work includes the support of the preparation, execution and documentation of the validation, in close cooperation with HC (FSP)'s experts.

Deep Blue will actively contribute to the SPR-INTEROP-OSD document's SAR and HPAR sections respectively. Deep Blue's highly qualified experts will support the evaluation of Safety and Human Factors questionnaires and debriefing sessions during the validation exercise. (21.800,00€)

Does the participant envisage that part of its work is performed by linked third parties	N
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N.A.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
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N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
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N.A.

4.2.19 **Linked to HONEYWELL AEROSPACE - HONEYWELL**

Objective

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
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N.A.

Does the participant envisage that part of its work is performed by linked third parties	Y
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Work provided under SESAR 2020 will be coordinated and performed by Honeywell Aerospace SAS, located in Toulouse (France) together with Honeywell International, s.r.o., with sites in Prague and Brno (Czech Republic). These facilities are equipped with state of the art research and test laboratories enabling research, development, integration, verification and validation of various aircraft systems.

Special subject matter expertise and specific experience with development of high-maturity level product and service prototypes will be provided by Honeywell International Inc. (USA) and Honeywell spol. s.r.o. (Czech Republic).

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
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N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
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N.A.

4.2.20 Linked to INDRA SISTEMAS SA - INDRA

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N.A.	
Does the participant envisage that part of its work is performed by linked third parties	Y
<p>For the present proposal, INDRANAVIA AS is a linked third party of INDRA, as declared in the INDRA Proposal for Membership Accession -REF. SJU/LC/0122-CFP, dated 28-January-2016.”).</p> <p>INDRA NAVIA is a dedicated air traffic management technology company that designs, produces, and integrates communication, navigation, and surveillance technology for the world’s leading airports and air traffic control organizations. Specializing in highly configurable and customized solutions, the company works with customers deliver products and equipment in line with customer’s needs. More than 1200 airports around the world rely on InNOVA, GAREX and NORMARC, amongst them the major European hubs such as Paris Charles de Gaulle, London Heathrow and Amsterdam Schiphol.</p> <p>Through continuous technological development, INDRA NAVIA facilitates the modernisation of air traffic management capabilities and ensures state-of-the-art technology. The company uses its ongoing experience with over 1,000 diverse customers to adapt and enhance effective support to meet all customers' needs. Compliance with ISO9001 reflects the company's high quality management system, placing the customer first at all times.</p> <p>INDRA NAVIA has decades of experience in supplying highly safety critical equipment, and thereby in-depth knowledge and understanding of the applicable regulations and requirements, in particular related to safety assessment and process/verification requirements to various levels of safety critical equipment development and implementation. INDRA NAVIA therefore has a very good fundament for understanding the implications of bringing new equipment through approval processes to the market in the ATM domain. INDRA NAVIA was also a partner in SESAR1, through NATMIG. In SESAR 2020 Wave 1, Indra Navia participated in particular in PJ02, PJ03A/B, PJ05 and PJ28 as ground industry</p> <p>All the work to be done in this project will be shared between INDRA SISTEMAS in Spain and INDRA NAVIA in Norway. The platform to be used in this project will mainly build upon INDRANAVIA work in SESAR 2020 Wave 1. Indra Navia will then lead the work on platform development, which is the work requiring most effort.</p> <p>INDRA NAVIA will participate in PJ02-Solution 4 contributing to the validation activities from the ground infrastructure/equipment point of view, especially with a view of providing vertical guidance based on GBAS in the future, having possible navigation performance requirements in mind. This will mainly be done in the form of meetings/workshops and reviews.</p> <p>INDRA NAVIA will participate in PJ02-Solution 21 validating the use of AGL for providing guidance to aircraft and vehicle drivers in different visibility conditions. In this solution, INDRA NAVIA will contribute to the following activities:</p> <ul style="list-style-type: none"> - T21.01 - PJ.02-21 Solution Management and Communication - T21.02 - PJ.02-21 Concept Description (V3) - T21.03 - PJ.02-21 Technical Specification (V3) - T21.3.04 - PJ.02-21 VALP (V3) - T21.05 - PJ.02-21 Prototype Development (V3) 	

- T21.3.06.5 - PJ.02-21 Exercise 5 – Live Trial of Integrated Surface Management Budapest (V3)
- T21.07 - PJ.02-21 Validation Report (V3)
- T21.08 - PJ.02-21 CBA (V3)

Indra Business Consulting (IBC) is a Spanish consulting firm that provides comprehensive strategic consultancy solutions. It offers services ranging from development strategy to implementation, covering the entire life cycle of businesses and transport infrastructure (including air transportation), territorial development and logistics for the public and private sectors. IBC is an affiliate company of Indra.

Its expertise is found within from a team of over 120 highly-qualified consultants employing a multidisciplinary approach covering the fields of business management, public administration, engineering, traffic modelling, operations, economics, and information systems.

Over the course of twenty five years, it has built a broad portfolio of services, creating value through more than 1,000 projects in 35 countries, and serving over 350 clients.

IBC will participate in PJ02-Solution 21 leading the development of Cost Benefit Analysis (T21.08 - PJ.02-21 CBA (V3)) thanks to the previous experience in developing CBAs for several SESAR solutions within Wave 1, SESAR 1 and SESAR 2020 programmes

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
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N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
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N.A.

4.2.21 Linked to LEONARDO - LDO

Objective

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
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A subcontract is foreseen, covering tasks T21.05 (prototype development) and T21.06.4 (validation exercise no. 4 execution). In particular the subcontracted entity will provide technical support for development of software components, their integration into the LDO validation platform and the necessary testing activities.

The subcontracting is estimated to 110.000,00 euro. Subcontractor will be selected during the project.

Does the participant envisage that part of its work is performed by linked third parties	Y
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Telespazio, a joint venture between Leonardo (67%) and Thales (33%), is one of the world's leading players in satellite services. The company, headquartered in Rome (Italy), employs approximately 2500 people.

Telespazio relies on an international network of space centres and teleports and operates worldwide through many subsidiaries. In particular, it is present: in France with Telespazio France; in Germany

with Telespazio VEGA Deutschland, GAF and Spaceopal (a joint venture in which the German space agency DLR holds a 50% interest); in the United Kingdom with Telespazio VEGA United Kingdom; in Spain with Telespazio Iberica and in Romania with Rartel. Telespazio has consolidated its presence in South America with Telespazio Brasil and Telespazio Argentina. In Italy, the company is also present through e-GEOS (in which the Italian Space Agency holds a 20% interest).

Telespazio is a leading company in sectors that are becoming increasingly important to public institutions, business operators and consumers. Its activities range from the design and development of space systems to the management of launch services and in-orbit satellite control, from Earth observation services, integrated communications, satellite navigation and localization, to scientific programmes.

Telespazio relies on a wealth of experience of the highest level, stemming from technological expertise acquired over 50 years of business practice. The Company's experience is also drawn from the management of space infrastructure - including the Fucino Space Centre, the world's largest civilian teleport - as well as from its involvement in major space programmes, including: Galileo, EGNOS, Copernicus, COSMO-SkyMed, SICRAL and Göktürk.

The company now covers the whole space market value chain through its lines of business: Satellite Communications, Geo Information, Satellite Systems and Operations.

Telespazio responds to new demands in the satellite services market with innovative ideas, offering new solutions, implementing international projects. Today more than ever, Telespazio is a true innovator, transforming what were once just possibilities into real services available to an increasingly audience worldwide.

Relevant skills/experience/technologies:

SESAR2020

In the framework of SESAR 2020 Telespazio acts as Linked Third Party of Leonardo and takes part to the activities related to the Projects PJ03a, PJ10 e PJ14.

e-Airport

Telespazio coordinated the H2020 e-Airport project which consists in the development of an Apron Management System, based on GNSS positioning and integrity computation, able to carry out activities schedule, safe monitor and control of operations performed by the airport vehicles.

Apron management services aim at increasing airport capacity and safety in adverse meteorological conditions and at important high-density aerodromes.

In the framework of this SESAR2020 project, Telespazio will leverage on the experience gathered in previous projects (SESAR2020, SESAR 1, e-Airport, etc.) in order to contribute as follows for Satellite Communication and Navigation aspects.

☐ contribution to PJ2 solution 21 for qualify through the implementation of an operational Demo, the GNSS Apron Management System, which offers the following airport services:

- Automatic association of aircraft / stand / gate / service vehicles, planning and monitoring of airport services and notification of Target Off Block Time (TOBT) to ATC;
- Real-time monitoring and cartographic display of aircraft and vehicles moving in the airport apron (through the positioning of EGNOS and Galileo);
- Centralized monitoring of vehicle trajectories with alarm generation in case of:
 - Deviation from the assigned route (Corridor Monitoring);
 - Geofencing;
 - Collision Avoidance

LEONARDO Germany GmbH, formerly known as Selex ES GmbH or Gematronik Weather Radar Systems, is a German engineering company and is one of the top companies in the meteorological market.

LEONARDO Germany GmbH is a 100% affiliated company of LEONARDO spa. It is one of the leading companies in the meteorological market. Its involvement in solution 14 will be connected with meteorological needs for OIs AO-0334 and AO-0315 in terms of the development of a wind nowcasting algorithm, providing its core competences and expertise in meteorological engineering solutions for Wake Vortex Detections. Related to this, the service "METForWTS" designed in Wave1 (PJ18-04b on requirements from PJ02-01) shall be further developed from TRL4 to TRL6 readiness. This will be done respecting new requirements in solution 14. MET products needed especially for the METForWTS service will be further elaborated. In particular, the glide path Wind Profile from Lidar and Radar shall be enhanced using A/C's as a sensor (this is a link to Solution #110)) with a special focus on 10 min nowcast of wind, providing added value to the so far performed persistent forecasts based on 10 m winds. An implementation of METForWTS in GWMS (Ground Weather Management System, a prototype implementing the local 4DWxCube) for use in validation exercises is proposed as well. Therefore, LEONARDO Germany GmbH's contribution will exceed the overall LEONARDO contribution.

More than 50 years of experience, reliability and a professional approach to challenges have contributed to the company's excellent reputation among experts in meteorology, the aviation sector and other related fields. Worldwide, LEONARDO Germany GmbH has the leading position in the design, manufacturing and installation of weather radar systems and holistic adverse weather monitoring solutions for aviation applications comprising of radar, lidar and ground based wind shear systems (LLWAS). Up to now, more than 500 systems have been successfully put into operation in 75 different countries all over the world. Today, LEONARDO Germany GmbH focuses on providing customized systems, turn-key solutions for aviation applications and integrated information systems while at the same time being sensitive to individual customer needs

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
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N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
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N.A.

4.2.22 Linked to AIRTEL ATN LIMITED - AIRTEL (NATMIG)

No third parties involved

4.2.23 Linked to SAAB AKTIEBOLAG - SAAB (NATMIG)

No third parties involved

4.2.24 Linked to SINTEF - SINTEF (NATMIG)

No third parties involved

4.2.25 Linked to NATS (EN ROUTE) PUBLIC LIMITED COMPANY – NATS

No third parties involved

4.2.26 Linked to AEROPORTS DE PARIS - ADP (SEAC2020)

No third parties involved

4.2.27 Linked to AVINOR AS - Avinor (SEAC2020)

No third parties involved

4.2.28 Linked to HEATHROW AIRPORT LIMITED - HAL (SEAC2020)

No third parties involved

4.2.29 Linked to FLUGHAFEN MUNCHEN GMBH - MUC (SEAC2020)

No third parties involved

4.2.30 Linked to SCHIPHOL NEDERLAND B.V. - SNBV (SEAC2020)

No third parties involved

4.2.31 Linked to SWEDAVIA AB - Swed (SEAC2020)

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
Swedavia is planning to use subcontractor with expertise in concept development, coordination and validations. (2.500,00€)	
Does the participant envisage that part of its work is performed by linked third parties	N
N.A.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N.A.	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
N.A.	

4.2.32 Linked to FLUGHAFEN ZURICH AG - ZRH (SEAC2020)

No third parties involved

4.2.33 Linked to THALES LAS FRANCE SAS - THALES AIR SYS

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
Thales Air Sys (Thales LAS France SAS) intends to subcontract part of its work for solution 4 covering part of activities in T04.03 - PJ.02-04 Technical Specification, T04.05 - PJ.02-04 Prototype Development, T04.06.01 - PJ.02-04 Exercise 1 – RTS led by LFV/COOPANS. The subcontractors will provide technical expertise and support for technical specifications, low-level software design & development, integration and verification of components and validation platform. The subcontracting costs is estimated to 185 000 Euros.	

Thales Air Sys is not in a position to name its subcontractors for this project at this stage as, in accordance with the company's subcontracting and procurement policy, the selection of adequate subcontractors will be done in a timely manner through a competitive selection process.

Does the participant envisage that part of its work is performed by linked third parties Y

For this project, EDISOFT and NAV Portugal are Linked Third Parties of Thales Air Sys (Thales LAS France SAS) and contribute to the works for to the solutions 17 and 21.

EDISOFT

EDISOFT is a Thales Group company which promotes and delivers innovative security critical systems, for land, sea, air, space and cyberspace.

Having its HQ located in Lisbon area and deploying ATC systems around the world, EDISOFT is focused on providing its customers permanent access to the most advanced solutions for the Aeronautics, Space, Security and Defence domains.

From the delivery of Naval and Maritime Security world class systems to the development & integration of leading Air Traffic Management systems and highly critical Space software, EDISOFT brings its unique knowledge and competences on the development of customized solutions to support and cybersecure some of the most demanding customers worldwide

EDISOFT has contributed to SESAR2020 wave1 Projects PJ02 and PJ03b, by providing prototypes for enhanced airport operations.

NAV Portugal

NAV Portugal is responsible for the provision of operational and technical air navigation services in Portugal, in accordance with the Decree Law 404 of 18th December 1998, stating that Navegação Aérea de Portugal – NAV Portugal, E.P.E., (www.nav.pt), is a state-owned corporate public entity endowed with administrative and financial autonomy with own assets, under state supervision by the Ministry of Economy and Employment.

NAV Portugal provides air traffic services in the flight information regions (FIR) under Portuguese responsibility – Lisbon and Santa Maria (see map shown), as well in 10 Airports ATC TWR's. NAV has considerable experience as both a Continental (EUR) and an Oceanic (NAT) ANSP; including operational experience of CPDLC, ADS-C, ADS-B, WAM, as well as experience in research and demonstration projects gained via involvement in the AIRE and SJU initiatives (e.g the SALSA project).

Searidge Technologies

For this project, Searidge Technologies is Linked Third Party of Thales Air Sys (Thales LAS France SAS) and contribute to the solution 17, by providing camera tracker system in continuation of the work initiated in Wave1 PJ02-06.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement) N

N.A.

Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)? N

N.A.

4.2.34 Linked to THALES AVS FRANCE SAS - THALES Avionics

No third parties involved

5 Ethics and Security

5.1 Ethics

All participants of the AART project will conform to national and European legislation and regulations. In relation to this project these include:

- The Charter of Fundamental Rights of the EU
- Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data

During the project WP01 will ensure compliance with ethics. This means that WP01 will verify that all documents from the AART project are following European ethical rules and the ethical rules of the concerned country.

During project Kick-off Meeting, WP01 will conduct an information session in order to draw attention to, and inform partners of all relevant ethical issues.

In the following sub-section further explanation is given for the self-assessment presented in the Proposal Submission Forms “Ethics issue table”. This is to provide an overview about the potential ethical issues and handling relating to research activities in the AART project.

5.1.1 Humans

In the project experimental studies will be conducted to gain knowledge about human-machine interaction. For these experimental studies healthy adults (no vulnerable adults), like Pilots or Air Traffic Controllers, will be recruited on a voluntary basis. Participants of these studies will be clearly informed of the research goals, the methodology of data protection and possible adverse events in a presentation of the research project and in interviews at the beginning of the study. According to the declaration of Helsinki, subjects are free to leave any test at any time without giving any reason and without raising any disadvantages – the project thereby complies with standard protocols surrounding a participant having the right to withdraw from the study. This will be ensured by a written agreement between the experimenter and the test subject (see questionnaire below).

Participant Agreement Form SESAR 2020 Validation/Demonstration activities

Full title of project/solution:

Full title of validation/demonstration activity and dates:

Name and contact details of project/solution leader:

**Please Initial
or
Tick Here**

I am aware of the main aspects of the Validation/Demonstration Plan for the above SESAR 2020 activity.	
I confirm that I have had the opportunity to ask questions.	
I understand that my participation is voluntary.	
I understand that my answers to any questionnaire related to human factors aspects (evaluation of workload, situational awareness, human machine interface usability...) will remain anonymous.	
Should I not wish to answer any particular question(s), I am free to decline.	
I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the outputs that result from the research without my agreement.	
I agree to take part in the above validation/demonstration activity.	

Name of Participant Date Signature

Name of Project/Solution Leader Date Signature

This form should be signed and dated by all parties after the participant receives a copy of the participant information sheet and any other written information provided to the participants. A copy of the signed and dated participant agreement form should be kept with the project's main documents which must be kept in a secure location.

Section: Humans		YES	NO	Information to be provided	Documents to be provided
Does your research involve human participants?		X		Confirmation about obtained Informed consent of the participants.	
If YES:	Are they volunteers for social or human sciences research?		X	Volunteers will be registered volunteers. Details on recruitment, inclusion	Examples of "informed consent form" and "information sheets"

Section: Humans	YES	NO	Information to be provided	Documents to be provided
			and exclusion criteria and informed consent procedures	
Are they persons unable to give informed consent (including children/minors)?		X		
Are they vulnerable individuals or groups?		X		
Are they children/minors?		X		
Are they patients?		X		
Are they healthy volunteers for medical studies		X	Note: The project will use healthy volunteers, but in the project no medical studies are foreseen.	
Does your research also involve physical interventions on the study participants?		X		

5.1.2 Protection of Personal Data

In advance and during the study personal data will be acquired. This data will be protected regarding article 8 – protection of personal data – of the European Charter of Fundamental Rights and the Treaty on the Functioning of the European Union. Furthermore, a strategy and methodology based on the Data Protection Directive will be developed and implemented to ensure the integrity and security of data during the project.

During the recruitment of subjects for the study, some necessary personal information relevant to the study (e.g. experience of work, age, gender) will be stored electronically in computers on a hard drive. This data will not be stored in a cloud solution or portable hard drives or USB sticks. This data will be password protected and only accessible to authorised researchers.

During the study performance only necessary data will be acquired and stored electronically. This data will be password protected and only accessible to authorised researchers. All data will be stored in a strict anonymous way. Subjects are allocated a unique subject number instead of their first- or surname. The subject number will be assigned randomly at the beginning of the study. This procedure ensures that it will not be possible to somehow associate the data to individual persons. Thus, the data will not be used to judge or assess the professional capabilities of the recruited subjects. The data is purely a means to investigate general cognitive processes.

Section: Protection of Personal Data	YES	NO	Information to be provided	Documents to be provided
Does your research involve personal data collection and/or processing?	X			Free and fully Informed consent sheets (see section 2) of the persons concerned (data subjects) will be obtained

Section: Protection of Personal Data	YES	NO	Information to be provided	Documents to be provided
If YES: Does it involve the collection or processing of sensitive personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?		X		
Does it involve processing of genetic information?		X		
Does it involve tracking or observation of participants (e.g. surveillance or localization data, and WAN data such as IP address, cookies, etc.)?		X		
Does your research involve further processing of previously collected personal data (secondary use) (including use of pre-existing data sets or sources, merging existing data sets, sharing data with non-EU member states)?		X		

5.1.3 Misuse

The AART project is part of the SESAR 2020 Programme and as such will be supervised by the SESAR Joint Undertaking and its members of the Administration Board. Several independent advisors are included in that body: e.g. Staff Representative, Airspace User, Military, and Scientific Community Representative. The SJU has or will expand on the development of a strategy on how to deal with possible risks regarding misuse and possible consequences during the project execution inside of SESAR 2020.

In the case that ethical issues arise unexpectedly during the project, the project coordinator will contact the Commission immediately and provide detailed information on the issue and how the project team intend to handle it.

5.1.4 Other Ethics Issues

At this stage of the project proposal there are no other ethics issues that should be taken into consideration. In the case that other ethical issues arise unexpectedly during the project, the project coordinator will contact the Commission immediately and provide detailed information on the issue and how the project team intend to handle it.

5.2 Security

Section: Security	YES	NO	Information to be provided	Documents to be provided
Are activities planned or results expected raising security issues?		X		
Are 'EU-classified information' as background or results foreseen?		X		

Abbreviations

Acronym	Definition	Page
AFCS	Automatic Flight Control System	25
AFIS	Aerodrome Flight Information Service	41
AGL	Airfield Ground Lighting	7
AGS	Analysis Ground Station	6
AIREP	Aircraft Report	22
AMAN	Arrival Manager/Management	3
ANSP	Air Navigation Service Provider	32
APCH	Approach	4
APOC	Airport Operations Centre	21
APP	Approach	12
A-SMGCS	Advanced-Surface Movement Guidance and Control System	7
ATC	Air Traffic Control	3
ATCO	Air Traffic Controller	4
ATM	Air Traffic Management	9
ATS	Air traffic services	6
ATSAW	Airborne Traffic Situational Awareness	6
BTV	Brake to Vacate	26
CBA	Cost Benefit Analysis	55
CCO	Continuous Climb Operations	4
CDM	Collaborative Decision Making	7
CDO	Continuous Descent Operations	4
CMAC	Conformance Monitoring Alerts for Controllers	7
CNS	Communication Navigation Surveillance	43
COTS	Commercial Off The Shelf	41
CPDLC	Controller–Pilot Data Link Communications	11
CSPR	Closely Spaced Parallel Runways	11

Acronym	Definition	Page
CVS	Combined Vision System	7
CWP	Controller Working Position	6
DCB	Demand Capacity Balancing	34
DMAN	Departure manager	3
DVBC	Dynamic Virtual Block Control	18
EAP	Enhanced Approach Procedure	5
EATM	European Air Traffic Management	3
EATMA	European Air Traffic Management Architecture	53
EBS	Enhanced Breaking System	11
EFVS	Enhanced Flight Vision System	15
EPMB	Extended Project Management Board	2
EPP	Extended Projected Profile	11
EVS	Enhanced Flight Vision Systems	44
FANS	Future Air Navigation System	19
FF-ICE	Flight & Flow Information for a Collaborative Environment	11
FIS	Flight Information Service	6
FMS	Flight Management System	25
FTS	Fast Time Simulation	4
GBAS	Ground-Based Augmentation System	8
GNSS	Global Navigation Satellite System	2
GRF	Global Reporting Format	39
GWMS	Ground Weather Management System	30
HDD	Head Down Display	33
HMD	Head Mounted Display	33
HMI	Human Machine Interface	6
HPC	High-Performance Computing	69
HUD	Head Up Display	7

Acronym	Definition	Page
IATA	International Air Transport Association	20
IBP	International Boundary Point	36
ICAO	International Civil Aviation Organization	4
IFR	Instrument Flight Rules	13
IGS	Increased Glide Slope	12
IGWG	International Ground Based Augmentation System (GBAS) Working Group	26
ILS	Instrument Landing System	4
IMB	Integrated Module Board	25
IPPC	Internet Pilot Planning Center	54
IRS	Interface Requirement Specification	54
ITWP	Integrated Tower Working Position	29
KPA	Key Performance Area	42
LATO	Landing and Take-Off focus group	26
LIDAR	Light Detection and RAnging	13
LMCT	Lockheed Martin Coherent Technologies	30
LPV	Localizer Performance with Vertical Guidance	6
LTP	Linked Third Party	64
LVC	Low Visibility Conditions	15
LVP	Low Visibility Procedures	16
MASPS	Minimum Aviation System Performance Standards	44
MCMF	Multi-Constellation Multi-Frequency	7
MOPS	Minimum Operational Performance Standards	42
MRS	Minimum Radar Separation	9
MTOM	Maximum Take Off Weight	14
NDA	Non-Disclosure Agreement	45
NTZ	No Transgression Zone	9

Acronym	Definition	Page
OBACS	On-board Braking Action Computation System	38
OPS	Operations	24
ORD	Optimised Runway Delivery	30
OSD	Optimised Separation Delivery	30
PANS	Procedures for Air Navigation Services	24
PAPI	Precision Approach Path Indicator	27
PBN	Performance Based Navigation	4
PCP	Pilot Common Project	44
PMB	Project Management Board	2
PMP	Project Management Plan	50
POC	Point Of Contact	52
PRU	Performance Review Unit	40
PWS	Pair Wise Separation	13
RAISG	RNAV Approach implementation Support Group	26
RCAM	Airport Condition Reporting and the Runway Condition Assessment Matrix	38
RMCA	Runway Monitoring and Conflict Alerting	15
RNP	Required Navigation Performance	4
ROAAS	Runway Overrun Awareness and Alerting System	21
ROT	Runway Occupancy Time	5
RTCA	Radio Technical Commission for Aeronautics	44
RTS	Real Time Simulation	4
RTWR	Remote Tower	44
RVR	Runway Visual Range	16
RWYCC	Runway Condition Codes	21
SARPS	Standards and Recommended Practices	44
SBAS	Satellite-based Augmentation System	6

Acronym	Definition	Page
SDM	SESAR Deployment Manager	6
SGA	Specific Grant Agreement	49
SID	Standard Instrument Departure	8
SJU	SESAR Joint Undertaking	3
SMA	SESAR2020 Management Agreement	49
SMAN	Surface Management	36
SMR	Surface Movement Radar	6
SOIR	Simultaneous Operations on parallel (or near-parallel) Instrument Runways	24
SPD	SESAR JU Single Programming Document	8
SPR	Safety And Performance Requirement	26
SRAP	Second Runway Aiming Point	12
SVGS	Synthetic Vision Guidance System	7
SVS	Synthetic Vision System	15
SWIM	System Wide Information Management	22
TALPA	Take-off And Landing Performance Assessment	42
TBS	Time Based Separations	6
TMA	Terminal Management Area	2
TOD	Top of Descent	19
TWR	Tower	13
VALP	Validation Plan	54
VALR	Validation Report	55
VBC	Virtual Block Control	18
VLD	Very Large Demonstration	23
VNAV	Vertical Navigation	5
VSF	Virtual Stop Bar	17
VSIB	Virtual System Integration Bed	25

Acronym	Definition	Page
WVAS	Wake Vortex Advisory System	24

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible ¹ costs (per budget category)										JU contribution			Additional information			
	A. Direct personnel costs				B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs		E. Indirect costs ²	Total costs	Reimbursement rate %	Maximum JU contribution ³	Maximum grant amount ⁴	Information for indirect costs	Information for auditors	Other information:	
	A.1 Employees (or equivalent)		A.4 SME owners without salary				D.1 Travel	D.5 Costs of internally invoiced goods and services						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving JU funding/ international partners	
Form of costs ⁶	Actual	Unit ⁷	Unit ⁸		Actual	Actual	Actual	Unit ⁹	Flat-rate ¹⁰								
	a	Total b	No hours	Total c	d	[e]	f	Total g	h = 0,25 x (a +b+c+f+g +[i1] ¹³ + [i2] ¹³ -n)	j = a+b+c+d +[e]/+f+g+h +[i1]/+[i2]	k	l	m	n	Yes/No		
1. EUROCONTROL ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		18 464 343.75
2. AIRBUS SAS	0.00	467 714.00	0.00	0.00	100 000.00	0.00	50 000.00	0.00	129 428.50	747 142.50	70.00	522 999.75	337 499.70	0.00	No		n/a
- AI OP SAS	0.00	1 958 737.00	0.00	0.00	562 000.00	0.00	150 000.00	0.00	527 184.25	3 197 921.25	70.00	2 238 544.88	1 444 567.11	0.00	No		n/a
Total beneficiary	0.00	2 426 451.00			662 000.00	0.00	200 000.00	0.00	656 612.75	3 945 063.75		2 761 544.63	1 782 066.81	n/a	n/a		0.00
3. PANSА (B4)	190 868.53	0.00	0.00	0.00	0.00	0.00	162 114.00	0.00	58 034.63	411 017.16	70.00	287 712.01	185 664.94	120 844.00	No		n/a
- WASKO S.A.	198 870.00	0.00	0.00	0.00	0.00	0.00	80 000.00	0.00	69 717.50	348 587.50	70.00	244 011.25	157 464.17	0.00	No		n/a
- UNIWARSAW	352 070.46	0.00	0.00	0.00	0.00	0.00	72 520.00	0.00	106 147.62	530 738.08	70.00	371 516.66	239 745.36	0.00	No		n/a
- MICROSTEP-MIS	251 000.00	0.00	0.00	0.00	0.00	0.00	72 000.00	0.00	80 750.00	403 750.00	70.00	282 625.00	182 382.22	0.00	No		n/a
Total beneficiary	992 808.99	0.00	0.00	0.00	0.00	0.00	386 634.00	0.00	314 649.75	1 694 092.74		1 185 864.92	765 256.69	n/a	n/a		0.00
4. LFV/COOPANS	535 200.00	0.00	0.00	0.00	0.00	0.00	138 941.00	0.00	168 535.25	842 676.25	70.00	589 873.38	380 654.28	0.00	No		n/a
5. DASSAULT	698 170.00	0.00	0.00	0.00	57 000.00	0.00	60 600.00	0.00	189 692.50	1 005 462.50	70.00	703 823.75	454 188.19	0.00	No		n/a
6. DFS	702 116.00	0.00	0.00	0.00	0.00	0.00	10 800.00	0.00	178 229.00	891 145.00	70.00	623 801.50	402 548.61	0.00	No		n/a
7. ENAIRE	597 030.80	0.00	0.00	0.00	37 280.00	0.00	30 730.00	0.00	156 940.20	821 981.00	70.00	575 386.70	371 305.80	0.00	No		n/a
- CRIDA	180 000.00	0.00	0.00	0.00	0.00	0.00	20 000.00	0.00	50 000.00	250 000.00	70.00	175 000.00	112 930.17	0.00	No		n/a
Total beneficiary	777 030.80	0.00			37 280.00	0.00	50 730.00	0.00	206 940.20	1 071 981.00		750 386.70	484 235.97	n/a	n/a		0.00
8. ENAV	345 600.00	0.00	0.00	0.00	0.00	0.00	38 400.00	0.00	96 000.00	480 000.00	70.00	336 000.00	216 825.92	0.00	No		n/a
- IDS AIRNAV	21 600.00	0.00	0.00	0.00	0.00	0.00	2 400.00	0.00	6 000.00	30 000.00	70.00	21 000.00	13 551.62	0.00	No		n/a
- NAIS	72 000.00	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	20 000.00	100 000.00	70.00	70 000.00	45 172.07	0.00	No		n/a
- TECHNO SKY	201 600.00	0.00	0.00	0.00	0.00	0.00	22 400.00	0.00	56 000.00	280 000.00	70.00	196 000.00	126 481.78	0.00	No		n/a
- NAV CANADA	144 000.00	0.00	0.00	0.00	0.00	0.00	16 000.00	0.00	40 000.00	200 000.00	70.00	140 000.00	90 344.13	0.00	No		n/a
Total beneficiary	784 800.00	0.00	0.00	0.00	0.00	0.00	87 200.00	0.00	218 000.00	1 090 000.00		763 000.00	492 375.52	n/a	n/a		0.00
9. HC (FSP)	154 189.00	0.00	0.00	0.00	21 800.00	0.00	44 600.00	0.00	49 697.25	270 286.25	70.00	189 200.38	122 093.89	0.00	No		n/a
10. Honeywell SAS	0.00	88 564.25	0.00	0.00	0.00	0.00	0.00	0.00	22 141.06	110 705.31	70.00	77 493.72	50 007.88	0.00	No		n/a
- HIsro	0.00	874 178.50	0.00	0.00	0.00	0.00	155 759.00	0.00	257 484.38	1 287 421.88	70.00	901 195.32	581 555.06	0.00	No		n/a
- HInc	0.00	103 781.25	0.00	0.00	0.00	0.00	0.00	0.00	25 945.31	129 726.56	70.00	90 808.59	58 600.17	0.00	No		n/a
Total beneficiary	0.00	1 066 524.00	0.00	0.00	0.00	0.00	155 759.00	0.00	305 570.75	1 527 853.75		1 069 497.63	690 163.11	n/a	n/a		0.00
11. INDRA	1 784 734.00	0.00	0.00	0.00	0.00	0.00	93 933.00	0.00	469 666.75	2 348 333.75	70.00	1 643 833.63	1 060 790.88	0.00	No		n/a
- INDRA NAVIA	728 080.00	0.00	0.00	0.00	0.00	0.00	38 320.00	0.00	191 600.00	958 000.00	70.00	670 600.00	432 748.39	0.00	No		n/a
- IBC	23 749.00	0.00	0.00	0.00	0.00	0.00	1 250.00	0.00	6 249.75	31 248.75	70.00	21 874.13	14 115.71	0.00	No		n/a
Total beneficiary	2 536 563.00	0.00			0.00	0.00	133 503.00	0.00	667 516.50	3 337 582.50		2 336 307.76	1 507 654.98	n/a	n/a		0.00
12. LDO	595 260.33	0.00	0.00	0.00	110 000.00	0.00	109 181.00	0.00	176 110.33	990 551.66	70.00	693 386.16	447 452.65	0.00	No		n/a
- LDO GMBH	114 080.00	0.00	0.00	0.00	0.00	0.00	6 005.00	0.00	30 021.25	150 106.25	70.00	105 074.38	67 806.10	0.00	No		n/a

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible ¹ costs (per budget category)									JU contribution			Additional information			
	A. Direct personnel costs			B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs		E. Indirect costs ²	Total costs	Reimbursement rate %	Maximum JU contribution ³	Maximum grant amount ⁴	Information for indirect costs	Information for auditors	Other information:	
	A.1 Employees (or equivalent)		A.4 SME owners without salary				D.1 Travel	D.5 Costs of internally invoiced goods and services					Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving JU funding/ international partners	
Form of costs ⁶	Actual	Unit ⁷	Unit ⁸		Actual	Actual	Actual	Unit ⁹	Flat-rate ¹⁰							
								25%								
	a	Total b	No hours	Total c	d	[e]	f	Total g	h = 0,25 x (a +b+c+f+g +[i1] ¹³ + [i2] ¹³ -n)	j = a+b+c+d +[e]/+f+g+h +[i1]/+[i2]	k	l	m	n	Yes/No	
- TPZ	64 962.67	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	18 240.67	91 203.34	70.00	63 842.34	41 198.43	0.00	No	n/a
Total beneficiary	774 303.00	0.00			110 000.00	0.00	123 186.00	0.00	224 372.25	1 231 861.25		862 302.88	556 457.18	n/a	n/a	0.00
13. SINTEF (NATMIG)	0.00	184 638.00	0.00	0.00	0.00	0.00	18 000.00	0.00	50 659.50	253 297.50	70.00	177 308.25	114 419.71	0.00	No	n/a
14. NATS	313 291.00	0.00	0.00	0.00	0.00	0.00	46 709.00	0.00	90 000.00	450 000.00	70.00	315 000.00	203 274.30	0.00	No	n/a
15. Avinor-SEAC2020	57 600.00	0.00	0.00	0.00	0.00	0.00	6 400.00	0.00	16 000.00	80 000.00	70.00	56 000.00	36 137.65	0.00	No	n/a
16. HAL (SEAC2020)	42 000.00	0.00	0.00	0.00	0.00	0.00	6 000.00	0.00	12 000.00	60 000.00	70.00	42 000.00	27 103.24	0.00	No	n/a
17. Swed (SEAC2020)	100 000.00	0.00	0.00	0.00	2 500.00	0.00	106 000.00	0.00	51 500.00	260 000.00	70.00	182 000.00	117 447.37	0.00	No	n/a
18. THALES AIR SYS	1 401 122.00	0.00	0.00	0.00	185 000.00	0.00	114 345.00	0.00	378 866.75	2 079 333.75	70.00	1 455 533.63	939 278.01	0.00	No	n/a
- EDISOFT	890 330.00	0.00	0.00	0.00	0.00	0.00	122 262.00	0.00	253 148.00	1 265 740.00	70.00	886 018.00	571 760.91	0.00	No	n/a
- NAV PORTUGAL	328 335.00	0.00	0.00	0.00	0.00	0.00	30 000.00	0.00	89 583.75	447 918.75	70.00	313 543.13	202 334.16	0.00	No	n/a
- SEARIDGE	86 286.00	0.00	0.00	0.00	0.00	0.00	28 000.00	0.00	28 571.50	142 857.50	70.00	100 000.25	64 531.69	0.00	No	n/a
Total beneficiary	2 706 073.00	0.00			185 000.00	0.00	294 607.00	0.00	750 170.00	3 935 850.00		2 755 095.01	1 777 904.77	n/a	n/a	0.00
19. THALES AVS	1 235 326.00	0.00	0.00	0.00	0.00	0.00	29 220.00	0.00	316 136.50	1 580 682.50	70.00	1 106 477.75	714 026.94	0.00	No	n/a
20. ANS CR (B4) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
21. LPS SR (B4) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
22. ON (B4) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
23. ACG/ COOPANS ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
24. CCL/ COOPANS ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
25. IAA/ COOPANS ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
26. Naviair/ COOPANS ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
27. ATOS (FSP) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
28. FRQ (FSP) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
29. AIRTEL (NATMIG) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
30. SAAB (NATMIG) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
31. ADP (SEAC2020) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible ¹ costs (per budget category)										JU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	<i>[C. Direct costs of fin. support]</i>	D. Other direct costs		E. Indirect costs ²	Total costs	Reimbursement rate %	Maximum JU contribution ³	Maximum grant amount ⁴	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent)		A.4 SME owners without salary				D.1 Travel	D.5 Costs of internally invoiced goods and services						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving JU funding/ international partners
A.2 Natural persons under direct contract		A.5 Beneficiaries that are natural persons without salary		D.2 Equipment												
A.3 Seconded persons				D.3 Other goods and services												
<i>[A.6 Personnel for providing access to research infrastructure]</i>				<i>[D.4 Costs of large research infrastructure]</i>												
Form of costs ⁶	Actual	Unit ⁷	Unit ⁸				Actual									
									25%							
	a	Total b	No hours	Total c	d	<i>[e]</i>	f	Total g	$h = 0,25 \times (a + b + c + f + g + [i1]^{13} + [i2]^{13} - n)$	$j = a + b + c + d + [e] + f + g + h + [i1] + [i2]$	k	l	m	n	Yes/No	
32. MUC (SEAC2020) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
33. SNBV (SEAC2020) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
34. ZRH (SEAC2020) ¹⁴	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
Total consortium	12 409 470.79	3 677 613.00		0.00	1 075 580.00	0.00	1 898 889.00	0.00	4 466 282.20	23 527 834.99		16 469 484.54	10 628 009.21			18 464 343.75

¹ See Article 6 for the eligibility conditions.

² Indirect costs already covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary/linked third party that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless it can demonstrate that the operating grant does not cover any costs of the action (see Article 6.2.E).

³ This is the theoretical amount of JU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the JU decided to grant for the action) (see Article 5.1).

⁴ The 'maximum grant amount' is the maximum grant amount decided by the JU. It normally corresponds to the requested grant, but may be lower.

⁵ Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.

⁶ See Article 5 for the forms of costs.

⁷ Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to the beneficiary's usual accounting practice.

⁸ See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).

⁹ Unit and costs per unit : calculated according to the beneficiary's usual accounting practices.

¹⁰ Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E).

¹¹ See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).

¹² See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc).

¹³ Only specific unit costs that do not include indirect costs.

¹⁴ See Article 9 for beneficiaries not receiving JU funding.

¹⁵ Only for linked third parties that receive JU funding.

ANNEX 2a**ADDITIONAL INFORMATION ON THE ESTIMATED BUDGET**

- Instructions and footnotes in blue will not appear in the text generated by the IT system (since they are internal instructions only).
- For options [in square brackets]: the applicable option will be chosen by the IT system. Options not chosen will automatically not appear.
- For fields in [grey in square brackets] (even if they are part of an option as specified in the previous item): IT system will enter the appropriate data.

⚠ Transitory period: Until SyGMA fully supports Annex 2a, you must prepare it manually (using this template by choosing and deleting the options/entering the appropriate data).
 For the 'unit cost tables': either fill them out manually or use currently existing tables from Annex 1 or the proposal.
 The document can then be uploaded in SyGMA and attached to the grant agreement.

Unit cost for SME owners/natural beneficiaries without salary**1. Costs for a [SME owner]/beneficiary that is a natural person/ not receiving a salary**

Units: hours worked on the action

Amount per unit ('hourly rate'): calculated according to the following formula:

{the monthly living allowance for researchers in MSCA-IF actions / 143 hours}
 multiplied by
 {country-specific correction coefficient of the country where the beneficiary is established}

The monthly living allowance and the country-specific correction coefficients are set out in the Work Programme (section 3 MSCA) in force at the time of the call:

- for calls *before* Work Programme 2018-2020:
 - for the monthly living allowance: **EUR 4 650**
 - for the country-specific correction coefficients: see Work Programme 2014-2015 and Work Programme 2016-2017 (available on the [Participant Portal Reference Documents](#) page)
- for calls *under* Work Programme 2018-2020:
 - for the monthly living allowance: **EUR 4 880**
 - for the country-specific correction coefficients: see Work Programme 2018-2020 (available on the [Participant Portal Reference Documents](#) page)

[additional OPTION for beneficiaries/linked third parties that have opted to use the unit cost (in the proposal/with an amendment): For the following beneficiaries/linked third parties, the amounts per unit (hourly rate) are fixed as follows:

- beneficiary/linked third party [short name]: EUR [insert amount]
 - beneficiary/linked third party [short name]: EUR [insert amount]
- [same for other beneficiaries/linked third parties, if necessary]]

Estimated number of units: see Annex 2

Energy efficiency measures unit cost

2. Costs for energy efficiency measures in buildings

Unit: m² of eligible ‘conditioned’ (i.e. built or refurbished) floor area

Amount per unit*: see (for each beneficiary/linked third party and BEST table) the ‘unit cost table’ attached

* Amount calculated as follows:
{EUR 0.1 x estimated total kWh saved per m² per year x 10}

Estimated number of units: see (for each beneficiary/linked third party and BEST table) the ‘unit cost table’ attached

Unit cost table (energy efficiency measures unit cost)¹

Short name beneficiary/linked third party	BEST No	Amount per unit	Estimated No of units	Total unit cost (cost per unit x estimated no of units)

¹ Data from the ‘building energy specification table (BEST)’ that is part of the proposal and Annex 1.

Research infrastructure unit cost

3. Access costs for providing trans-national access to research infrastructure

Units²: see (for each access provider and installation) the ‘unit cost table’ attached

Amount per unit^{*}: see (for each access provider and installation) the ‘unit cost table’ attached

* Amount calculated as follows:

$$\frac{\text{average annual total access cost to the installation (over past two years}^3\text{)}}{\text{average annual total quantity of access to the installation (over past two years}^4\text{)}}$$

Estimated number of units: see (for each access provider and installation) the ‘unit cost table’ attached

Unit cost table (access to research infrastructure unit cost)⁵

Short name access provider	Short name infrastru cture	Installation		Unit of access	Amount per unit	Estimated No of units	Total unit cost (cost per unit x estimated no of units)
		No	Short name				

Clinical studies unit cost

4. Costs for clinical studies

Units: patients/subjects that participate in the clinical study

Amount per unit^{*}: see (for each sequence (if any), clinical study and beneficiary/linked third party) the ‘unit cost table’ attached

* Amount calculated, for the cost components of each task, as follows:

For **personnel costs**:

For personnel costs of doctors: ‘average hourly cost for doctors’, i.e.:

{certified or auditable total personnel costs for doctors for year N-1

{ 1720 * number of full-time-equivalent for doctors for year N-1 }

multiplied by

estimated number of hours to be worked by doctors for the task (per participant)}

For personnel costs of other medical personnel: ‘average hourly cost for other medical personnel’, i.e.:

{certified or auditable total personnel costs for other medical personnel for year N-1

{ 1720 * number of full-time-equivalent for other medical personnel for year N-1 }

² Unit of access (e.g. beam hours, weeks of access, sample analysis) fixed by the access provider in proposal.

³ In exceptional and duly justified cases, the Commission/Agency may agree to a different reference period.

⁴ In exceptional and duly justified cases, the Commission/Agency may agree to a different reference period.

⁵ Data from the ‘table on estimated costs/quantity of access to be provided’ that is part of the proposal and Annex 1.

H2020 Templates: Annex 2a (Additional information on the estimated budget)

multiplied by
estimated number of hours to be worked by other medical personnel for the task (per participant)}

For personnel costs of technical personnel: 'average hourly cost for technical personnel', i.e.:

$$\frac{\{\text{certified or auditable total personnel costs for technical personnel for year N-1}\}}{\{1720 * \text{number of full-time-equivalent for technical personnel for year N-1}\}}$$

multiplied by
estimated number of hours to be worked by technical personnel for the task (per participant)}

'total personnel costs' means actual salaries + actual social security contributions + actual taxes and other costs included in the remuneration, provided they arise from national law or the employment contract/equivalent appointing act

For **consumables**:

For each cost item: 'average price of the consumable', i.e.:

$$\frac{\{\{\text{certified or auditable total costs of purchase of the consumable in year N-1}\}}{\text{total number of items purchased in year N-1}\}}$$

multiplied by
estimated number of items to be used for the task (per participant)}

'total costs of purchase of the consumable' means total value of the supply contracts (including related duties, taxes and charges such as non-deductible VAT) concluded by the beneficiary for the consumable delivered in year N-1, provided the contracts were awarded according to the principle of best value- for-money and without any conflict of interests

For **medical equipment**:

For each cost item: 'average cost of depreciation and directly related services per unit of use', i.e.:

$$\frac{\{\{\text{certified or auditable total depreciation costs in year N-1} + \text{certified or auditable total costs of purchase of services in year N-1 for the category of equipment concerned}\}}{\text{total capacity in year N-1}}}$$

multiplied by
estimated number of units of use of the equipment for the task (per participant)}

'total depreciation costs' means total depreciation allowances as recorded in the beneficiary's accounts of year N-1 for the category of equipment concerned, provided the equipment was purchased according to the principle of best value for money and without any conflict of interests + total costs of renting or leasing contracts (including related duties, taxes and charges such as non-deductible VAT) in year N-1 for the category of equipment concerned, provided they do not exceed the depreciation costs of similar equipment and do not include finance fees

For **services**:

For each cost item: 'average cost of the service per study participant', i.e.:

$$\frac{\{\text{certified or auditable total costs of purchase of the service in year N-1}\}}{\text{total number of patients or subjects included in the clinical studies for which the service was delivered in year N-1}\}}$$

'total costs of purchase of the service' means total value of the contracts concluded by the beneficiary (including related duties, taxes and charges such as non-deductible VAT) for the specific service delivered in year N-1 for the conduct of clinical studies, provided the contracts were awarded according to the principle of best value for money and without any conflict of interests

For **indirect costs**:

$$\{\{\{\text{cost component 'personnel costs'} + \text{cost component 'consumables'} + \text{cost component 'medical equipment'}\}\}$$

minus

$$\{\text{costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises} + \text{costs of providing financial support to third parties (if any)}\}$$

multiplied by

$$25\% \}$$

H2020 Templates: Annex 2a (Additional information on the estimated budget)

The estimation of the resources to be used must be done on the basis of the study protocol and must be the same for all beneficiaries/linked third parties/third parties involved.

The year N-1 to be used is the last closed financial year at the time of submission of the grant application.

Estimated number of units: see (for each clinical study and beneficiary/linked third party) the 'unit cost table' attached

Unit cost table: clinical studies unit cost⁶

Task, Direct cost categories	Resource per patient	Costs year N-1 Beneficiary 1 [short name]	Costs year N-1 Linked third party 1a [short name]	Costs year N-1 Beneficiary 2 [short name]	Costs year N-1 Linked third party 2a [short name]	Costs year N-1 Third party giving in-kind contributions 1 [short name]
Sequence No. 1						
Task No. 1 Blood sample						
(a) Personnel costs:						
- Doctors	n/a					
- Other Medical Personnel	Phlebotomy (nurse), 10 minutes	8,33 EUR	11,59 EUR	10,30 EUR	11,00 EUR	9,49 EUR
- Technical Personnel	Sample Processing (lab technician), 15 minutes	9,51 EUR	15,68 EUR	14,60 EUR	15,23 EUR	10,78 EUR
(b) Costs of consumables:	Syringe	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	Cannula	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	Blood container	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(c) Costs of medical equipment:	Use of -80° deep freezer, 60 days	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	Use of centrifuge, 15 minutes	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(d) Costs of services	Cleaning of XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(e) Indirect costs (25% flat-rate)		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
Task No. 2						
...						
Amount per unit (unit cost sequence 1):		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
Sequence No. 2						
Task No. 1						

⁶ Same table as in proposal and Annex 1.

H2020 Templates: Annex 2a (Additional information on the estimated budget)

XXX						
(a) Personnel costs:						
- Doctors	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
- Other Medical Personnel	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
- Technical Personnel	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(b) Costs of consumables:	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(c) Costs of medical equipment:	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(d) Costs of services	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(e) Indirect costs (25% flat-rate)		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
Task No. 2						
...						
Amount per unit (unit cost sequence 2):		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
...						
Amount per unit (unit cost entire study):		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AIRBUS (AIRBUS SAS), established in 2 ROND POINT EMILE DEWOITINE, BLAGNAC 31700, France, VAT number: FR89383474814, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('2')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

POLSKA AGENCJA ZEGLUGI POWIETRZNEJ (PANSA (B4)), established in UL. WIEZOWA 8, WARSZAWA 02 147, Poland, VAT number: PL5222838321, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('3')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LUFTFARTSVERKET (LFV/COOPANS), established in HOSPITALSGATAN 30, NORRKOPING 602 27, Sweden, VAT number: SE202100079501, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('4')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DASSAULT AVIATION (DASSAULT), established in 9 ROND POINT CHAMPS-ELYSEES-MARCEL DASSAULT, PARIS 75008, France, VAT number: FR73712042456, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('5')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS), established in AM DFS CAMPUS 10, LANGEN 63225, Germany, VAT number: DE114110232, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('6')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ENAIRE (ENAIRE), established in AVENIDA DE ARAGON S/N BLOQUE 330, PORTAL 2 PARQUE EMPRESARIAL LAS MERCEDES, MADRID 28022, Spain, VAT number: ESQ2822001J, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('7')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ENAV SPA (ENAV), established in VIA SALARIA 716, ROMA 00138, Italy, VAT number: IT02152021008, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('8')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG (HC (FSP)), established in IGLO UTCA 33 35, BUDAPEST 1185, Hungary, VAT number: HU13851325, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('9')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION and the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HONEYWELL AEROSPACE (Honeywell SAS), established in 4 AVENUE SAINT GRANIER, TOULOUSE 31300, France, VAT number: FR92340797919, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('10')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INDRA SISTEMAS SA (INDRA), established in AVENIDA DE BRUSELAS 35, ALCOBENDAS MADRID 28108, Spain, VAT number: ESA28599033, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('11')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LEONARDO - SOCIETA PER AZIONI (LDO), established in PIAZZA MONTE GRAPPA 4, ROMA 00195, Italy, VAT number: IT00881841001, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('12')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SINTEF AS (SINTEF (NATMIG)), established in STRINDVEGEN 4, TRONDHEIM 7034, Norway, VAT number: NO919303808MVA, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('13')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

NATS (EN ROUTE) PUBLIC LIMITED COMPANY (NATS), established in 4000 PARKWAY WHITELEY, FAREHAM PO15 7FL, United Kingdom, VAT number: GB440379456, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('14')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AVINOR AS (Avinor-SEAC2020), established in DRONNING EUFEMIAS GATE 6, OSLO 2061, Norway, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('15')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HEATHROW AIRPORT LIMITED (HAL (SEAC2020)), established in NELSON ROAD THE COMPASS CENTRE HOUNSLOW, LONDON TW6 2GW, United Kingdom, VAT number: GB927365404, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('16')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SWEDAVIA AB (Swed (SEAC2020)), established in SWEDAVIA, STOCKHOLM ARLANDA 190 45, Sweden, VAT number: SE556797081801, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('17')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THALES LAS FRANCE SAS (THALES AIR SYS), established in AVENUE GAY LUSSAC 2, ELANCOURT 78990, France, VAT number: FR15319159877, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('18')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THALES AVS FRANCE SAS (THALES AVS), established in 75-77 AVENUE MARCEL DASSAULT, MERIGNAC 33700, France, VAT number: FR65612039495, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('19')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4)), established in JENEC NAVIGACNI 787, JENEC 252 61, Czechia, VAT number: CZ699004742, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('20')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK (LPS SR (B4)), established in IVANSKA CESTA 93, BRATISLAVA 823 07, Slovakia, VAT number: SK2020244699, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('21')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

VALSTYBES IMONE ORO NAVIGACIJA (ON (B4)), established in RODUNIOS KEL 2, VILNIAUS 02188, Lithuania, VAT number: LT100604610, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('22')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH (ACG/COOPANS), established in WAGRAMER STRASSE 19, WIEN 1220, Austria, VAT number: ATU37259408, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('23')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION and the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD (CCL/COOPANS), established in RUDOLFA FIZIRA 2, VELIKA GORICA 10410, Croatia, VAT number: HR33052761319, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('24')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION and the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY (IAA/ COOPANS), established in D'OLIER STREET 11-12 THE TIMES BUILDING, DUBLIN D02 T449, Ireland, VAT number: IE8211082B, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('25')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

NAVIAIR (Naviair/COOPANS), established in NAVIAIR ALLE 1, KASTRUP 2770, Denmark, VAT number: DK26059763, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('26')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ATOS BELGIUM (ATOS (FSP)), established in DA VINCILAAN 5, ZAVENTEM 1930, Belgium, VAT number: BE0401848135, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('27')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FREQUENTIS AG (FRQ (FSP)), established in Innovationsstrasse 1, WIEN 1100, Austria, VAT number: ATU14715600, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('28')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AIRTEL ATN LIMITED (AIRTEL (NATMIG)), established in 2 HARBOUR SQUARE CROFTON ROAD, DUN LOAGHAIRE DUBLIN A96D6R0, Ireland, VAT number: IE8287698U, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('29')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SAAB AKTIEBOLAG (SAAB (NATMIG)), established in ., LINKOPING 581 88, Sweden, VAT number: SE556036079301, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('30')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AEROPORTS DE PARIS SA (ADP (SEAC2020)), established in 1 RUE DE FRANCE, TREMBLAY-EN-FRANCE 93290, France, VAT number: FR33552016628, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('31')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FLUGHAFEN MUNCHEN GMBH (MUC (SEAC2020)), established in NORDALLEE 25, MUNCHEN 85326, Germany, VAT number: DE129352365, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('32')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SCHIPHOL NEDERLAND B.V. (SNBV (SEAC2020)), established in EVERT VAN DE BEEKSTRAAT 202, LUCHTHAVEN SCHIPHOL 1118CP, Netherlands, VAT number: NL810336406B01, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('33')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FLUGHAFEN ZURICH AG (ZRH (SEAC2020)), established in FLUGHAFEN KLOTEN, ZURICH 8058, Switzerland, VAT number: CHE101921104MWST, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('34')

in Grant Agreement No 874477 ('the Agreement')

between EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Airport airside and runway throughput (PJ02-W2 AART)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

FINANCIAL STATEMENT FOR [BENEFICIARY [name]/ LINKED THIRD PARTY [name]] FOR REPORTING PERIOD [reporting period]

	Eligible ¹ costs (per budget category)													Receipts	EU contribution			Additional information	
	A. Direct personnel costs			B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs			E. Indirect costs ²	[F. Costs of ...]		Total costs	Receipts	Reimburse ment rate %	Maximum EU contribution ³	Requested EU contribution	Information for indirect costs :		
	A.1 Employees (or equivalent)	A.2 Natural persons under direct contract	A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]	A.4 SME owners without salary	A.5 Beneficiaries that are natural persons without salary	[C.1 Financial support]	[C.2 Prizes]	D.1 Travel	D.2 Equipment	D.3 Other goods and services	[D.4 Costs of large research infrastructure]	D.5 Costs of internally invoiced goods and services	[F.1 Costs of ...]	[F.2 Costs of ...]	Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				Costs of in-kind contributions not used on premises
Form of costs ⁴	Actual	Unit	Unit	Actual	Actual	Actual	Actual	Unit	Flat-rate ⁵	Unit	[Unit][Lump sum]								
									25%										
	a	Total b	No hours	Total c	d	[e]	f	[g]	Total h	i=0,25 x (a+b+c+f+[g] + h+[j 1] ⁶ +[j2] ⁶ -p)	No units	Total [j1]	Total [j2]	k = a+b+c+d+[e] +f+[g] +h+ i + [j1] +[j2]	l	m	n	o	p
[short name beneficiary/linked third party]																			

The beneficiary/linked third party hereby confirms that:
The information provided is complete, reliable and true.
The costs declared are eligible (see Article 6).
The costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 17, 18 and 22).
For the last reporting period: that all the receipts have been declared (see Article 5.3.3).

❗ Please declare all eligible costs, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace other costs that are found to be ineligible.

¹ See Article 6 for the eligibility conditions
² The indirect costs claimed must be free of any amounts covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.2.E). If you have received an operating grant during this reporting period, you cannot claim indirect costs unless you can demonstrate that the operating grant does not cover any costs of the action.
³ This is the *theoretical* amount of EU contribution that the system calculates automatically (by multiplying the reimbursement rate by the total costs declared). The amount you request (in the column 'requested EU contribution') may be less,
⁴ See Article 5 for the forms of costs
⁵ Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E)
⁶ Only specific unit costs that do not include indirect costs

ANNEX 5

MODEL FOR THE CERTIFICATE ON THE FINANCIAL STATEMENTS

- For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data

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TERMS OF REFERENCE FOR AN INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

Terms of Reference for an Independent Report of Factual Findings on costs declared under a Grant Agreement financed by [Clean Sky 2] [Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research (SESAR)][Shift2Rail] JU under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the ‘**Terms of Reference (ToR)**’ under which

[OPTION 1: *[insert name of the beneficiary]* (*‘the Beneficiary’*)] [OPTION 2: *[insert name of the linked third party]* (*‘the Linked Third Party’*), third party linked to the Beneficiary *[insert name of the beneficiary]* (*‘the Beneficiary’*)]

agrees to engage

[insert legal name of the auditor] (*‘the Auditor’*)

to produce an independent report of factual findings (*‘the Report’*) concerning the Financial Statement(s)¹ drawn up by the *[Beneficiary]* *[Linked Third Party]* for the Horizon 2020 grant agreement *[insert number of the grant agreement, title of the action, acronym and duration from/to]* (*‘the Agreement’*), and

to issue a Certificate on the Financial Statements’ (*‘CFS’*) referred to in Article 20.4 of the Agreement based on the compulsory reporting template stipulated by the European Commission (*‘the Commission’*).

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and the *[Clean Sky 2][Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research (SESAR)][Shift2Rail]* Joint Undertaking (*“the JU”*).

The JU is mentioned as a signatory of the Agreement with the Beneficiary only. The JU is not a party to this engagement.

1.1 Subject of the engagement

The coordinator must submit to the JU the final report within 60 days following the end of the last reporting period which should include, amongst other documents, a CFS for each beneficiary and for each linked third party that requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 20.4 of the Agreement). The CFS must cover all reporting periods of the beneficiary or linked third party indicated above.

The Beneficiary must submit to the coordinator the CFS for itself and for its linked third party(ies), if the CFS must be included in the final report according to Article 20.4 of the Agreement.

The CFS is composed of two separate documents:

- The Terms of Reference (*‘the ToR’*) to be signed by the *[Beneficiary]* *[Linked Third Party]* and the Auditor;

¹ By which costs under the Agreement are declared (see template ‘Model Financial Statements’ in Annex 4 to the Grant Agreement).



- The Auditor's Independent Report of Factual Findings ('the Report') to be issued on the Auditor's letterhead, dated, stamped and signed by the Auditor (or the competent public officer) which includes the agreed-upon procedures ('the Procedures') to be performed by the Auditor, and the standard factual findings ('the Findings') to be confirmed by the Auditor.

If the CFS must be included in the final report according to Article 20.4 of the Agreement, the request for payment of the balance relating to the Agreement cannot be made without the CFS. However, the payment for reimbursement of costs covered by the CFS does not preclude the JU, the Commission, the European Anti-Fraud Office and the European Court of Auditors from carrying out checks, reviews, audits and investigations in accordance with Article 22 of the Agreement.

1.2 Responsibilities

The *[Beneficiary]* *[Linked Third Party]*:

- must draw up the Financial Statement(s) for the action financed by the Agreement in compliance with the obligations under the Agreement. The Financial Statement(s) must be drawn up according to the *[Beneficiary's]* *[Linked Third Party's]* accounting and book-keeping system and the underlying accounts and records;
- must send the Financial Statement(s) to the Auditor;
- is responsible and liable for the accuracy of the Financial Statement(s);
- is responsible for the completeness and accuracy of the information provided to enable the Auditor to carry out the Procedures. It must provide the Auditor with a written representation letter supporting these statements. The written representation letter must state the period covered by the statements and must be dated;
- accepts that the Auditor cannot carry out the Procedures unless it is given full access to the *[Beneficiary's]* *[Linked Third Party's]* staff and accounting as well as any other relevant records and documentation.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].*
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the *[Beneficiary's]* *[Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with this ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary]* *[Linked Third Party]*.

The Commission sets out the Procedures to be carried out by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement, the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with²:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the JU requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there is no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]*, and must specify - if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7).

Under Article 22 of the Agreement, the JU, the Commission, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from the European Union budget. This includes work related to this engagement. The Auditor must provide access to all working papers (e.g. recalculation of hourly rates, verification of the time declared for the action) related to this assignment if the JU, the Commission, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

1.6 Other terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor]	[legal name of the [Beneficiary][Linked Third Party]]
[name & function of authorised representative]	[name & function of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor	Signature of the [Beneficiary][Linked Third Party]

² Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

**Independent Report of Factual Findings on costs declared
under a grant agreement financed by the [Clean Sky 2] [Bio Based Industries][ECSEL][Fuel
Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic
Management Research (SESAR)][Shift2Rail] JU under the Horizon 2020 Research and
Innovation Framework Programme**

(To be printed on the Auditor's letterhead)

To
[name of contact person(s)], [Position]
[[Beneficiary's] [Linked Third Party's] name]
[Address]
[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of
the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of
the beneficiary] ('the Beneficiary')],

we

[name of the auditor] ('the Auditor'),
established at
[full address/city/state/province/country],
represented by
[name and function of an authorised representative],

have carried out the procedures agreed with you regarding the costs declared in the Financial
Statement(s)³ of the [Beneficiary] [Linked Third Party] concerning the grant agreement
[insert grant agreement reference: number, title of the action and acronym] ('the Agreement'),

with a total cost declared of
[total amount] EUR,

and a total of actual costs and unit costs calculated in accordance with the [Beneficiary's] [Linked
Third Party's] usual cost accounting practices' declared of

[sum of total actual costs and total direct personnel costs declared as unit costs calculated in
accordance with the [Beneficiary's] [Linked Third Party's] usual cost accounting practices] EUR

and **hereby provide our Independent Report of Factual Findings ('the Report')** using the
compulsory report format agreed with you.

The Report

³ By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in
Annex 4 to the Agreement).



Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') examined.

The Procedures were carried out solely to assist the JU in evaluating whether the [Beneficiary's] [Linked Third Party's] costs in the accompanying Financial Statement(s) were declared in accordance with the Agreement. The JU draws its own conclusions from the Report and any additional information it may require.

The scope of the Procedures was defined by the European Commission ('the Commission'). Therefore, the Auditor is not responsible for their suitability or pertinence. Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, the Auditor does not give a statement of assurance on the Financial Statements.

Had the Auditor carried out additional procedures or an audit of the [Beneficiary's] [Linked Third Party's] Financial Statements in accordance with International Standards on Auditing or International Standards on Review Engagements, other matters might have come to its attention and would have been included in the Report.

Not applicable Findings

We examined the Financial Statement(s) stated above and considered the following Findings not applicable:

Explanation (to be removed from the Report):

If a Finding was not applicable, it must be marked as 'N.A.' ('Not applicable') in the corresponding row on the right-hand column of the table and means that the Finding did not have to be corroborated by the Auditor and the related Procedure(s) did not have to be carried out.

The reasons of the non-application of a certain Finding must be obvious i.e.

- i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable;*
- ii) if the condition set to apply certain Procedure(s) are not met the related Finding(s) and those Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than euro' the Procedure and Finding related to 'beneficiaries with accounts established in euro' are not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.*

List here all Findings considered not applicable for the present engagement and explain the reasons of the non-applicability.

....

Exceptions

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and evaluate the Findings.

Explanation (to be removed from the Report):

- If the Auditor was not able to successfully complete a procedure requested, it must be marked as 'E' ('Exception') in the corresponding row on the right-hand column of the table. The reason such as the inability to reconcile key information or the unavailability of data that prevents the Auditor from carrying out the Procedure must be indicated below.*
- If the Auditor cannot corroborate a standard finding after having carried out the corresponding procedure, it must also be marked as 'E' ('Exception') and, where possible, the reasons why the Finding was not fulfilled and its possible impact must be explained here below.*

List here any exceptions and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, include the corresponding amount.

....

Example (to be removed from the Report):

1. *The Beneficiary was unable to substantiate the Finding number 1 on ... because*
2. *Finding number 30 was not fulfilled because the methodology used by the Beneficiary to calculate unit costs was different from the one approved by the Commission. The differences were as follows: ...*
3. *After carrying out the agreed procedures to confirm the Finding number 31, the Auditor found a difference of _____ EUR. The difference can be explained by ...*

Further Remarks

In addition to reporting on the results of the specific procedures carried out, the Auditor would like to make the following general remarks:

Example (to be removed from the Report):

1. *Regarding Finding number 8 the conditions for additional remuneration were considered as fulfilled because ...*
2. *In order to be able to confirm the Finding number 15 we carried out the following additional procedures:*

Use of this Report

This Report may be used only for the purpose described in the above objective. It was prepared solely for the confidential use of the [Beneficiary] [Linked Third Party], the JU and the Commission, and only to be submitted to the JU in connection with the requirements set out in Article 20.4 of the Agreement. The Report may not be used by the [Beneficiary] [Linked Third Party], by the JU or the Commission for any other purpose, nor may it be distributed to any other parties. The JU or the Commission may only disclose the Report to authorised parties, in particular to the European Anti-Fraud Office (OLAF) and the European Court of Auditors.

This Report relates only to the Financial Statement(s) submitted to the JU by the [Beneficiary] [Linked Third Party] for the Agreement. Therefore, it does not extend to any other of the [Beneficiary's] [Linked Third Party's] Financial Statement(s).

There was no conflict of interest⁴ between the Auditor and the Beneficiary [and Linked Third Party] in establishing this Report. The total fee paid to the Auditor for providing the Report was EUR [] (including EUR [] of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance.

[legal name of the Auditor]

⁴ A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Grant Agreement number: [insert number] [insert acronym] [insert call identifier]  Associated with document Ref. Ares(2019)7362963 - 29/11/2019

[name and function of an authorised representative]

[dd Month yyyy]

Signature of the Auditor

Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor

The European Commission ('the Commission') reserves the right to i) provide the auditor with additional guidance regarding the procedures to be followed or the facts to be ascertained and the way in which to present them (this may include sample coverage and findings) or to ii) change the procedures, by notifying the Beneficiary in writing. The procedures carried out by the auditor to confirm the standard factual finding are listed in the table below.

If this certificate relates to a Linked Third Party, any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

The 'result' column has three different options: 'C', 'E' and 'N.A.':

- 'C' stands for 'confirmed' and means that the auditor can confirm the 'standard factual finding' and, therefore, there is no exception to be reported.
- 'E' stands for 'exception' and means that the Auditor carried out the procedures but cannot confirm the 'standard factual finding', or that the Auditor was not able to carry out a specific procedure (e.g. because it was impossible to reconcile key information or data were unavailable),
- 'N.A.' stands for 'not applicable' and means that the Finding did not have to be examined by the Auditor and the related Procedure(s) did not have to be carried out. The reasons of the non-application of a certain Finding must be obvious i.e. i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable; ii) if the condition set to apply certain Procedure(s) are not met then the related Finding(s) and Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than the euro' the Procedure related to 'beneficiaries with accounts established in euro' is not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A	ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICE		
	<p>The Auditor draws a sample of persons whose costs were declared in the Financial Statement(s) to carry out the procedures indicated in the consecutive points of this section A.</p> <p><i>(The sample should be selected randomly so that it is representative. Full coverage is required if there are fewer than 10 people (including employees, natural persons working under a direct contract and personnel seconded by a third party), otherwise the sample should have a minimum of 10 people, or 10% of the total, whichever number is the highest)</i></p> <p>The Auditor sampled [] people out of the total of [] people.</p>		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.1	<p>PERSONNEL COSTS</p> <p><u>For the persons included in the sample and working under an employment contract or equivalent act (general procedures for individual actual personnel costs and personnel costs declared as unit costs)</u></p> <p>To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> ○ a list of the persons included in the sample indicating the period(s) during which they worked for the action, their position (classification or category) and type of contract; ○ the payslips of the employees included in the sample; ○ reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system; ○ information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent; ○ the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay); ○ applicable national law on taxes, labour and social security and ○ any other document that supports the personnel costs declared. <p>The Auditor also verified the eligibility of all components of the retribution (see Article 6 GA) and recalculated the personnel costs for employees included in the sample.</p>	1) The employees were i) directly hired by the Beneficiary in accordance with its national legislation, ii) under the Beneficiary's sole technical supervision and responsibility and iii) remunerated in accordance with the Beneficiary's usual practices.	
		2) Personnel costs were recorded in the Beneficiary's accounts/payroll system.	
		3) Costs were adequately supported and reconciled with the accounts and payroll records.	
		4) Personnel costs did not contain any ineligible elements.	
		5) There were no discrepancies between the personnel costs charged to the action and the costs recalculated by the Auditor.	
	<p><i>Further procedures if 'additional remuneration' is paid</i></p> <p>To confirm standard factual findings 6-9 listed in the next column, the Auditor:</p> <ul style="list-style-type: none"> ○ reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory 	6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation, the Beneficiary's usual remuneration practice for projects funded under national funding schemes ...);</p> <ul style="list-style-type: none"> recalculated the amount of additional remuneration eligible for the action based on the supporting documents received (full-time or part-time work, exclusive or non-exclusive dedication to the action, usual remuneration paid for projects funded by national schemes) to arrive at the applicable FTE/year and pro-rata rate (see data collected in the course of carrying out the procedures under A.2 'Productive hours' and A.4 'Time recording system'). <p><i>'ADDITIONAL REMUNERATION' MEANS ANY PART OF THE REMUNERATION WHICH EXCEEDS WHAT THE PERSON WOULD BE PAID FOR TIME WORKED IN PROJECTS FUNDED BY NATIONAL SCHEMES.</i></p> <p><i>IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE IS QUALIFIED AS "ADDITIONAL REMUNERATION" AND IS ELIGIBLE UNDER THE PROVISIONS OF ARTICLE 6.2.A.1, THIS CAN BE CHARGED AS ELIGIBLE COST TO THE ACTION UP TO THE FOLLOWING AMOUNT:</i></p> <p>(A) <i>IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR;</i></p> <p>(B) <i>IF THE PERSON WORKS EXCLUSIVELY ON THE ACTION BUT NOT FULL-TIME OR NOT FOR THE FULL YEAR: UP TO THE CORRESPONDING PRO-RATA AMOUNT OF EUR 8 000, OR</i></p> <p>(C) <i>IF THE PERSON DOES NOT WORK EXCLUSIVELY ON THE ACTION: UP TO A PRO-RATA AMOUNT CALCULATED IN ACCORDANCE TO ARTICLE 6.2.A.1.</i></p>	<p>7) The amount of additional remuneration paid corresponded to the Beneficiary's usual remuneration practices and was consistently paid whenever the same kind of work or expertise was required.</p>	
		<p>8) The criteria used to calculate the additional remuneration were objective and generally applied by the Beneficiary regardless of the source of funding used.</p>	
		<p>9) The amount of additional remuneration included in the personnel costs charged to the action was capped at EUR 8,000 per FTE/year (up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).</p>	
	<p><i>Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied:</i></p> <p>Apart from carrying out the procedures indicated above to confirm standard factual findings 1-5 and, if applicable, also 6-9, the Auditor carried out following procedures to confirm standard</p>	<p>10) The personnel costs included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice. This methodology was consistently</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>factual findings 10-13 listed in the next column:</p> <ul style="list-style-type: none"> obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs; reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; verified the employees included in the sample were charged under the correct category (in accordance with the criteria used by the Beneficiary to establish personnel categories) by reviewing the contract/HR-record or analytical accounting records; verified that there is no difference between the total amount of personnel costs used in calculating the cost per unit and the total amount of personnel costs recorded in the statutory accounts; verified whether actual personnel costs were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, objective and supported by documents. 	used in all H2020 actions.	
		11) The employees were charged under the correct category.	
		12) Total personnel costs used in calculating the unit costs were consistent with the expenses recorded in the statutory accounts.	
		13) Any estimated or budgeted element used by the Beneficiary in its unit-cost calculation were relevant for calculating personnel costs and corresponded to objective and verifiable information.	
	<p><u>For natural persons included in the sample and working with the Beneficiary under a direct contract other than an employment contract, such as consultants (no subcontractors).</u></p> <p>To confirm standard factual findings 14-17 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary; the employment conditions of staff in the same category to compare costs and; any other document that supports the costs declared and its registration (e.g. invoices, accounting records, etc.). 	14) The natural persons worked under conditions similar to those of an employee, in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed.	
		15) The results of work carried out belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		results were generated by itself.	
		16) Their costs were not significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		17) The costs were supported by audit evidence and registered in the accounts.	
	<u>For personnel seconded by a third party and included in the sample (not subcontractors)</u> To confirm standard factual findings 18-21 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: <ul style="list-style-type: none"> ○ their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results; ○ if there is reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution against payment): any documentation that supports the costs declared (e.g. contract, invoice, bank payment, and proof of registration in its accounting/payroll, etc.) and reconciliation of the Financial Statement(s) with the accounting system (project accounting and general ledger) as well as any proof that the amount invoiced by the third party did not include any profit; ○ if there is no reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution free of charge): a proof of the actual cost borne by the Third Party for the resource made available free of charge to the Beneficiary such as a statement of costs incurred by the Third Party and proof of the registration in the Third Party's accounting/payroll; 	18) Seconded personnel reported to the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		19) The results of work carried out belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those results were generated by itself.	
		<i>If personnel is seconded against payment:</i>	
		20) The costs declared were supported with documentation and recorded in the Beneficiary's accounts. The	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<ul style="list-style-type: none"> any other document that supports the costs declared (e.g. invoices, etc.). 	third party did not include any profit.	
		<i>If personnel is seconded free of charge:</i> 21) The costs declared did not exceed the third party's cost as recorded in the accounts of the third party and were supported with documentation.	
A.2	PRODUCTIVE HOURS To confirm standard factual findings 22-27 listed in the next column, the Auditor reviewed relevant documents, especially national legislation, labour agreements and contracts and time records of the persons included in the sample, to verify that: <ul style="list-style-type: none"> the annual productive hours applied were calculated in accordance with one of the methods described below, the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated. If the Beneficiary applied method B, the auditor verified that the correctness in which the total number of hours worked was calculated and that the contracts specified the annual workable hours. If the Beneficiary applied method C, the auditor verified that the 'annual productive hours' applied when calculating the hourly rate were equivalent to at least 90 % of the 'standard annual workable hours'. The Auditor can only do this if the calculation of the standard annual workable	22) The Beneficiary applied method [<i>choose one option and delete the others</i>] [A: 1720 hours] [B: the 'total number of hours worked'] [C: 'standard annual productive hours' used correspond to usual accounting practices]	
		23) Productive hours were calculated annually.	
		24) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>hours can be supported by records, such as national legislation, labour agreements, and contracts.</p> <p><i>BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:</i></p> <p><i>A. 1720 ANNUAL PRODUCTIVE HOURS (PRO-RATA FOR PERSONS NOT WORKING FULL-TIME)</i></p> <p><i>B. THE TOTAL NUMBER OF HOURS WORKED BY THE PERSON FOR THE BENEFICIARY IN THE YEAR (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL NUMBER OF HOURS WORKED' IN THE NEXT COLUMN). THE CALCULATION OF THE TOTAL NUMBER OF HOURS WORKED WAS DONE AS FOLLOWS: ANNUAL WORKABLE HOURS OF THE PERSON ACCORDING TO THE EMPLOYMENT CONTRACT, APPLICABLE LABOUR AGREEMENT OR NATIONAL LAW PLUS OVERTIME WORKED MINUS ABSENCES (SUCH AS SICK LEAVE OR SPECIAL LEAVE).</i></p> <p><i>C. THE STANDARD NUMBER OF ANNUAL HOURS GENERALLY APPLIED BY THE BENEFICIARY FOR ITS PERSONNEL IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES (THIS METHOD IS ALSO REFERRED TO AS 'STANDARD ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS.</i></p> <p><i>'ANNUAL WORKABLE HOURS' MEANS THE PERIOD DURING WHICH THE PERSONNEL MUST BE WORKING, AT THE EMPLOYER'S DISPOSAL AND CARRYING OUT HIS/HER ACTIVITY OR DUTIES UNDER THE EMPLOYMENT CONTRACT, APPLICABLE COLLECTIVE LABOUR AGREEMENT OR NATIONAL WORKING TIME LEGISLATION.</i></p>	<p><i>If the Beneficiary applied method B.</i></p> <p>25) The calculation of the number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary.</p> <p>25.1) The Beneficiary calculates the hourly rates per full financial year following procedure A.3 (method B is not allowed for beneficiaries calculating hourly rates per month).</p>	
		<p><i>If the Beneficiary applied method C.</i></p> <p>26) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		27) The 'annual productive hours' used for calculating the hourly rate were consistent with the usual cost accounting practices of the Beneficiary and were equivalent to at least 90 % of the 'annual workable hours'.	
A.3	<p>HOURLY PERSONNEL RATES</p> <p><u>I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit costs):</u></p> <p>If the Beneficiary has a "Certificate on Methodology to calculate unit costs " (CoMUC) approved by the Commission, the Beneficiary provides the Auditor with a description of the approved methodology and the Commission's letter of acceptance. The Auditor verified that the Beneficiary has indeed used the methodology approved. If so, no further verification is necessary.</p> <p>If the Beneficiary does not have a "Certificate on Methodology" (CoMUC) approved by the Commission, or if the methodology approved was not applied, then the Auditor:</p> <ul style="list-style-type: none"> ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ recalculated the unit costs (hourly rates) of staff included in the sample following the results of the procedures carried out in A.1 and A.2. <p><u>II) For individual hourly rates:</u></p> <p>The Auditor:</p> <ul style="list-style-type: none"> ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ recalculated the hourly rates of staff included in the sample (recalculation of all hourly 	<p>28) The Beneficiary applied [<i>choose one option and delete the other</i>]:</p> <p>[Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"]</p> <p>[Option II: Individual hourly rates were applied]</p> <p><i>For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):</i></p> <p>29) The Beneficiary used the Commission-approved methodology to calculate hourly rates. It corresponded to the organisation's usual cost accounting practices and was applied consistently for all</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>rates if the Beneficiary uses annual rates, recalculation of three months selected randomly for every year and person if the Beneficiary uses monthly rates) following the results of the procedures carried out in A.1 and A.2;</p> <ul style="list-style-type: none"> ○ (only in case of monthly rates) confirmed that the time spent on parental leave is not deducted, and that, if parts of the basic remuneration are generated over a period longer than a month, the Beneficiary has included only the share which is generated in the month. <p><u>“UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES”:</u> <i>IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF THE CATEGORY TO WHICH THE EMPLOYEE BELONGS VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF FTE AND THE ANNUAL TOTAL PRODUCTIVE HOURS OF THE SAME CATEGORY CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH PROCEDURE A.2.</i> <u>HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS:</u> <i>IT IS CALCULATED FOLLOWING ONE OF THE TWO OPTIONS BELOW:</i></p> <p>A) [OPTION BY DEFAULT] BY DIVIDING THE ACTUAL ANNUAL AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2 (FULL FINANCIAL YEAR HOURLY RATE);</p> <p>B) BY DIVIDING THE ACTUAL MONTHLY AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY 1/12 OF THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2.(MONTHLY HOURLY RATE).</p>	<p>activities irrespective of the source of funding.</p> <p><i>For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the Commission:</i></p> <p>30) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.</p> <p><i>For option II concerning individual hourly rates:</i></p> <p>31) The individual rates re-calculated by the Auditor were the same as the rates applied by the Beneficiary.</p> <p>31.1) The Beneficiary used only one option (per full financial year or per month) throughout each financial year examined.</p> <p>31.2) The hourly rates do not include additional remuneration.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.4	TIME RECORDING SYSTEM To verify that the time recording system ensures the fulfilment of all minimum requirements and that the hours declared for the action were correct, accurate and properly authorised and supported by documentation, the Auditor made the following checks for the persons included in the sample that declare time as worked for the action on the basis of time records: <ul style="list-style-type: none"> ○ description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system); ○ its actual implementation; ○ time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager; ○ the hours declared were worked within the project period; ○ there were no hours declared as worked for the action if HR-records showed absence due to holidays or sickness (further cross-checks with travels are carried out in B.1 below) ; ○ the hours charged to the action matched those in the time recording system. 	32) All persons recorded their time dedicated to the action on a daily/ weekly/ monthly basis using a paper/computer-based system. <i>(delete the answers that are not applicable)</i>	
		33) Their time-records were authorised at least monthly by the project manager or other superior.	
		34) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.	
		35) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.	
	<p><i>ONLY THE HOURS WORKED ON THE ACTION CAN BE CHARGED. ALL WORKING TIME TO BE CHARGED SHOULD BE RECORDED THROUGHOUT THE DURATION OF THE PROJECT, ADEQUATELY SUPPORTED BY EVIDENCE OF THEIR REALITY AND RELIABILITY (SEE SPECIFIC PROVISIONS BELOW FOR PERSONS WORKING EXCLUSIVELY FOR THE ACTION WITHOUT TIME RECORDS).</i></p> <p><u>If the persons are working exclusively for the action and without time records</u></p> <p>For the persons selected that worked exclusively for the action without time records, the Auditor verified evidence available demonstrating that they were in reality exclusively dedicated to the action and that the Beneficiary signed a declaration confirming that they have worked exclusively for the action.</p>	36) The exclusive dedication is supported by a declaration signed by the Beneficiary and by any other evidence gathered.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
B	COSTS OF SUBCONTRACTING		
B.1	<p>The Auditor obtained the detail/breakdown of subcontracting costs and sampled cost items selected randomly <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).</i></p> <p>To confirm standard factual findings 37-41 listed in the next column, the Auditor reviewed the following for the items included in the sample:</p> <ul style="list-style-type: none"> ○ the use of subcontractors was foreseen in Annex 1; ○ subcontracting costs were declared in the subcontracting category of the Financial Statement; ○ supporting documents on the selection and award procedure were followed; ○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the subcontract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment). <p>In particular,</p> <ol style="list-style-type: none"> i. if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the subcontracting complied with the Terms and Conditions of the Agreement. ii. if the Beneficiary did not fall under the above-mentioned category the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement.. 	<p>37) The use of claimed subcontracting costs was foreseen in Annex 1 and costs were declared in the Financial Statements under the subcontracting category.</p> <p>38) There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. Subcontracts were awarded in accordance with the principle of best value for money.</p> <p><i>(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption “Exceptions” of the Report. The JU will analyse this information to evaluate whether these costs might be accepted as eligible)</i></p> <p>39) The subcontracts were not awarded to other Beneficiaries</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	For the items included in the sample the Auditor also verified that: <ul style="list-style-type: none"> ○ the subcontracts were not awarded to other Beneficiaries in the consortium; ○ there were signed agreements between the Beneficiary and the subcontractor; ○ there was evidence that the services were provided by subcontractor; 	of the consortium.	
		40) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor.	
		41) There was evidence that the services were provided by the subcontractors.	
C	COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES		
C.1	<p>The Auditor obtained the detail/breakdown of the costs of providing financial support to third parties and sampled [] cost items selected randomly <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).</i></p> <p>The Auditor verified that the following minimum conditions were met:</p> <ul style="list-style-type: none"> a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1; b) the financial support to third parties was agreed in Annex 1 of the Agreement and the other provisions on financial support to third parties included in Annex 1 were respected. 	42) All minimum conditions were met	

D	OTHER ACTUAL DIRECT COSTS		
D.1	COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES The Auditor sampled [] cost items selected randomly <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest).</i> The Auditor inspected the sample and verified that: <ul style="list-style-type: none"> ○ travel and subsistence costs were consistent with the Beneficiary's usual policy for travel. In this context, the Beneficiary provided evidence of its normal policy for travel costs (e.g. use of first class tickets, reimbursement by the Beneficiary on the basis of actual costs, a lump sum or per diem) to enable the Auditor to compare the travel costs charged with this policy; ○ travel costs are correctly identified and allocated to the action (e.g. trips are directly linked to the action) by reviewing relevant supporting documents such as minutes of meetings, workshops or conferences, their registration in the correct project account, their consistency with time records or with the dates/duration of the workshop/conference; ○ no ineligible costs or excessive or reckless expenditure was declared (see Article 6.5 MGA). 	43) Costs were incurred, approved and reimbursed in line with the Beneficiary's usual policy for travels.	
		44) There was a link between the trip and the action.	
		45) The supporting documents were consistent with each other regarding subject of the trip, dates, duration and reconciled with time records and accounting.	
		46) No ineligible costs or excessive or reckless expenditure was declared.	
D.2	DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS The Auditor sampled [] cost items selected randomly <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest).</i> For “equipment, infrastructure or other assets” [from now on called “asset(s)”] selected in the sample the Auditor verified that: <ul style="list-style-type: none"> ○ the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures; ○ they were correctly allocated to the action (with supporting documents such as delivery 	47) Procurement rules, principles and guides were followed.	
		48) There was a link between the grant agreement and the asset charged to the action.	
		49) The asset charged to the action was traceable to the accounting records and the underlying documents.	

	<p>note invoice or any other proof demonstrating the link to the action)</p> <ul style="list-style-type: none"> ○ they were entered in the accounting system; ○ the extent to which the assets were used for the action (as a percentage) was supported by reliable documentation (e.g. usage overview table); <p>The Auditor recalculated the depreciation costs and verified that they were in line with the applicable rules in the Beneficiary's country and with the Beneficiary's usual accounting policy (e.g. depreciation calculated on the acquisition value).</p> <p>The Auditor verified that no ineligible costs such as deductible VAT, exchange rate losses, excessive or reckless expenditure were declared (see Article 6.5 GA).</p>	<p>50) The depreciation method used to charge the asset to the action was in line with the applicable rules of the Beneficiary's country and the Beneficiary's usual accounting policy.</p>	
		<p>51) The amount charged corresponded to the actual usage for the action.</p>	
		<p>52) No ineligible costs or excessive or reckless expenditure were declared.</p>	
D.3	<p>COSTS OF OTHER GOODS AND SERVICES</p> <p>The Auditor sampled [] cost items selected randomly (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>).</p> <p>For the purchase of goods, works or services included in the sample the Auditor verified that:</p> <ul style="list-style-type: none"> ○ the contracts did not cover tasks described in Annex 1; ○ they were correctly identified, allocated to the proper action, entered in the accounting system (traceable to underlying documents such as purchase orders, invoices and accounting); ○ the goods were not placed in the inventory of durable equipment; ○ the costs charged to the action were accounted in line with the Beneficiary's usual accounting practices; ○ no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA). <p>In addition, the Auditor verified that these goods and services were acquired in conformity with the Beneficiary's internal guidelines and procedures, in particular:</p> <ul style="list-style-type: none"> ○ if Beneficiary acted as a contracting authority within the meaning of Directive 	<p>53) Contracts for works or services did not cover tasks described in Annex 1.</p>	
		<p>54) Costs were allocated to the correct action and the goods were not placed in the inventory of durable equipment.</p>	
		<p>55) The costs were charged in line with the Beneficiary's accounting policy and were adequately supported.</p>	
		<p>56) No ineligible costs or excessive or reckless expenditure were declared. For internal invoices/charges only the cost element was charged, without any mark-ups.</p>	

	<p>2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the procurement contract complied with the Terms and Conditions of the Agreement.</p> <ul style="list-style-type: none"> ○ if the Beneficiary did not fall into the category above, the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement. <p>For the items included in the sample the Auditor also verified that:</p> <ul style="list-style-type: none"> ○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the contract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Auditor also verified that the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment); <p><i>SUCH GOODS AND SERVICES INCLUDE, FOR INSTANCE, CONSUMABLES AND SUPPLIES, DISSEMINATION (INCLUDING OPEN ACCESS), PROTECTION OF RESULTS, SPECIFIC EVALUATION OF THE ACTION IF IT IS REQUIRED BY THE AGREEMENT, CERTIFICATES ON THE FINANCIAL STATEMENTS IF THEY ARE REQUIRED BY THE AGREEMENT AND CERTIFICATES ON THE METHODOLOGY, TRANSLATIONS, REPRODUCTION.</i></p>	<p>57) Procurement rules, principles and guides were followed. There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. The purchases were made in accordance with the principle of best value for money.</p> <p><i>(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The JU will analyse this information to evaluate whether these costs might be accepted as eligible)</i></p>	
D.4	<p>AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE</p> <p>The Auditor ensured the existence of a positive ex-ante assessment (issued by the EC Services) of the cost accounting methodology of the Beneficiary allowing it to apply the guidelines on direct costing for large research infrastructures in Horizon 2020.</p> <p><i>In the cases that a positive ex-ante assessment has been issued (see the standard factual findings 58-59 on the next column),</i></p>	<p>58) The costs declared as direct costs for Large Research Infrastructures (in the appropriate line of the Financial Statement) comply with the methodology described in the positive ex-ante assessment report.</p>	

	<p>The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment;</p> <p><i>In the cases that a positive ex-ante assessment has NOT been issued (see the standard factual findings 60 on the next column),</i></p> <p>The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category;</p> <p><i>In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes (see the standard factual findings 60 on the next column),</i></p> <ul style="list-style-type: none"> The Auditor followed the same procedure as above (when a positive ex-ante assessment has NOT yet been issued) and paid particular attention (testing reinforced) to the cost items for which the draft ex-ante assessment either rejected the inclusion as direct costs for Large Research Infrastructures or issued recommendations. 	59) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly.	
		60) The direct costs declared were free from any indirect costs items related to the Large Research Infrastructure.	
D.5	<p>Costs of internally invoiced goods and services</p> <p>The Auditor sampled cost items selected randomly (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>).</p> <p>To confirm standard factual findings 61-65 listed in the next column, the Auditor:</p> <ul style="list-style-type: none"> obtained a description of the Beneficiary's usual cost accounting practice to calculate costs of internally invoiced goods and services (unit costs); reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; ensured that the methodology to calculate unit costs is being used in a consistent manner, based on objective criteria, regardless of the source of funding; verified that any ineligible items or any costs claimed under other budget categories, in particular indirect costs, have not been taken into account when calculating the costs of internally invoiced goods and services (see Article 6 GA); verified whether actual costs of internally invoiced goods and services were adjusted on 	<p>61) The costs of internally invoiced goods and services included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice.</p> <p>62) The cost accounting practices used to calculate the costs of internally invoiced goods and services were applied by the Beneficiary in a consistent manner based on objective criteria regardless of the source of funding.</p> <p>63) The unit cost is calculated using the actual costs for the good or service recorded in the Beneficiary's accounts, excluding any ineligible cost or</p>	

	<p>the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, and correspond to objective and verifiable information.</p> <ul style="list-style-type: none"> o verified that any costs of items which are not directly linked to the production of the invoiced goods or service (e.g. supporting services like cleaning, general accountancy, administrative support, etc. not directly used for production of the good or service) have not been taken into account when calculating the costs of internally invoiced goods and services. o verified that any costs of items used for calculating the costs internally invoiced goods and services are supported by audit evidence and registered in the accounts. o 	<p>costs included in other budget categories.</p> <p>64) The unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.</p> <p>65) The costs items used for calculating the actual costs of internally invoiced goods and services were relevant, reasonable and correspond to objective and verifiable information.</p>	
E	USE OF EXCHANGE RATES		
E.1	<p>a) For Beneficiaries with accounts established in a currency other than euros</p> <p>The Auditor sampled [] cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>):</p> <p><i>COSTS RECORDED IN THE ACCOUNTS IN A CURRENCY OTHER THAN EURO SHALL BE CONVERTED INTO EURO AT THE AVERAGE OF THE DAILY EXCHANGE RATES PUBLISHED IN THE C SERIES OF OFFICIAL JOURNAL OF THE EUROPEAN UNION (https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html), DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.</i></p> <p><i>IF NO DAILY EURO EXCHANGE RATE IS PUBLISHED IN THE OFFICIAL JOURNAL OF THE EUROPEAN UNION FOR THE CURRENCY IN QUESTION, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE MONTHLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE (http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm),</i></p>	<p>66) The exchange rates used to convert other currencies into Euros were in accordance with the rules established of the Grant Agreement and there was no difference in the final figures.</p>	

	<i>DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.</i>		
	<p><u>b) For Beneficiaries with accounts established in euros</u></p> <p>The Auditor sampled [] cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>):</p> <p><i>COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO BY APPLYING THE BENEFICIARY'S USUAL ACCOUNTING PRACTICES.</i></p>	67) The Beneficiary applied its usual accounting practices.	

[legal name of the audit firm]

[name and function of an authorised representative]

[dd Month yyyy]

<Signature of the Auditor>

ANNEX 6

MODEL FOR THE CERTIFICATE ON THE METHODOLOGY

- For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data.

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TERMS OF REFERENCE FOR AN AUDIT ENGAGEMENT FOR A METHODOLOGY CERTIFICATE IN CONNECTION WITH ONE OR MORE GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON THE METHODOLOGY CONCERNING GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

**Terms of reference for an audit engagement for a methodology certificate
in connection with one or more grant agreements financed
by [Clean Sky 2] [Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative
Medicines Initiative 2][Single European Sky Air Traffic Management Research
(SESAR)][Shift2Rail] JU under the Horizon 2020 Research and Innovation Framework
Programme**

This document sets out the ‘**Terms of Reference (ToR)**’ under which

[OPTION 1: *[insert name of the beneficiary]* (*‘the Beneficiary’*)] [OPTION 2: *[insert name of the linked third party]* (*‘the Linked Third Party’*), third party linked to the Beneficiary *[insert name of the beneficiary]* (*‘the Beneficiary’*)]

agrees to engage

[insert legal name of the auditor] (*‘the Auditor’*)

to produce an independent report of factual findings (*‘the Report’*) concerning the *[Beneficiary’s]* *[Linked Third Party’s]* usual accounting practices for calculating and claiming direct personnel costs declared as unit costs (*‘the Methodology’*) in connection with grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme.

The procedures to be carried out for the assessment of the methodology will be based on the grant agreement(s) detailed below:

[title and number of the grant agreement(s)] (*‘the Agreement(s)’*)

The Agreement(s) has(have) been concluded between the Beneficiary and the *[Clean Sky 2][Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research (SESAR)][Shift2Rail]* Joint Undertaking (*‘the JU’*).

The JU is mentioned as a signatory of the Agreement with the Beneficiary only. The JU is not a party to this engagement.

1.1 Subject of the engagement

According to Article 18.1.2 of the Agreement, beneficiaries *[and linked third parties]* that declare direct personnel costs as unit costs calculated in accordance with their usual cost accounting practices may submit to the JU, for approval by the European Commission (*‘the Commission’*), a certificate on the methodology (*‘CoMUC’*) stating that there are adequate records and documentation to prove that their cost accounting practices used comply with the conditions set out in Point A of Article 6.2.

The subject of this engagement is the CoMUC which is composed of two separate documents:

- the Terms of Reference (*‘the ToR’*) to be signed by the *[Beneficiary]* *[Linked Third Party]* and the Auditor;
- the Auditor’s Independent Report of Factual Findings (*‘the Report’*) issued on the Auditor’s letterhead, dated, stamped and signed by the Auditor which includes; the standard statements (*‘the Statements’*) evaluated and signed by the *[Beneficiary]* *[Linked Third Party]*, the agreed-upon procedures (*‘the Procedures’*) performed by the Auditor and the standard factual findings (*‘the Findings’*) assessed by the Auditor. The Statements, Procedures and Findings are summarised in the table that forms part of the Report.

The information provided through the Statements, the Procedures and the Findings will enable the Commission to draw conclusions regarding the existence of the *[Beneficiary's] [Linked Third Party's]* usual cost accounting practice and its suitability to ensure that direct personnel costs claimed on that basis comply with the provisions of the Agreement. The Commission draws its own conclusions from the Report and any additional information it may require.

1.2 Responsibilities

The parties to this agreement are the *[Beneficiary] [Linked Third Party]* and the Auditor.

The *[Beneficiary] [Linked Third Party]*:

- is responsible for preparing financial statements for the Agreement(s) ('the Financial Statements') in compliance with those Agreements;
- is responsible for providing the Financial Statement(s) to the Auditor and enabling the Auditor to reconcile them with the *[Beneficiary's] [Linked Third Party's]* accounting and bookkeeping system and the underlying accounts and records. The Financial Statement(s) will be used as a basis for the procedures which the Auditor will carry out under this ToR;
- is responsible for its Methodology and liable for the accuracy of the Financial Statement(s);
- is responsible for endorsing or refuting the Statements indicated under the heading 'Statements to be made by the Beneficiary/ Linked Third Party' in the first column of the table that forms part of the Report;
- must provide the Auditor with a signed and dated representation letter;
- accepts that the ability of the Auditor to carry out the Procedures effectively depends upon the *[Beneficiary] [Linked Third Party]* providing full and free access to the *[Beneficiary's] [Linked Third Party's]* staff and to its accounting and other relevant records.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].*
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the Beneficiary's *[and Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with these ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out and the Findings to be endorsed by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with¹:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the Commission requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there was no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]* that could have a bearing on the Report, and must specify – if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7 of the Agreement).

Under Article 22 of the Agreement, the JU, the Commission, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from the European Union budget. This includes work related to this engagement. The Auditor must provide access to all working papers related to this assignment if the JU, the Commission, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

1.6 Other Terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor]
[name & title of authorised representative]
[dd Month yyyy]
Signature of the Auditor

[legal name of the [Beneficiary] [Linked Third Party]]
[name & title of authorised representative]
[dd Month yyyy]
Signature of the [Beneficiary] [Linked Third Party]

¹ Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

**Independent report of factual findings on the methodology concerning grant agreements
financed by *[Clean Sky 2] [Bio Based Industries][ECSEL][Fuel Cells and Hydrogen
2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research
(SESAR)][Shift2Rail] JU*
under the Horizon 2020 Research and Innovation Framework Programme**

(To be printed on letterhead paper of the auditor)

To

[name of contact person(s)], [Position]
[[Beneficiary's] [Linked Third Party's] name]
[Address]
[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: *[insert name of the beneficiary]* ('the Beneficiary')] [OPTION 2: *[insert name of the linked third party]* ('the Linked Third Party'), third party linked to the Beneficiary *[insert name of the beneficiary]* ('the Beneficiary')],

we

[name of the auditor] ('the Auditor'),
established at
[full address/city/state/province/country],
represented by
[name and function of an authorised representative],

have carried out the agreed-upon procedures ('the Procedures') and provide hereby our Independent Report of Factual Findings ('the Report'), concerning the *[Beneficiary's] [Linked Third Party's]* usual accounting practices for calculating and declaring direct personnel costs declared as unit costs ('the Methodology').

You requested certain procedures to be carried out in connection with the grant(s)

[title and number of the grant agreement(s)] ('the Agreement(s)').

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes: the standard statements ('the Statements') made by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') confirmed by us.

The engagement involved carrying out the Procedures and assessing the Findings and the documentation requested appended to this Report, the results of which the European Commission ('the Commission') uses to draw conclusions regarding the acceptability of the Methodology applied by the *[Beneficiary] [Linked Third Party]*.

The Report covers the methodology used from [dd Month yyyy]. In the event that the [Beneficiary] [Linked Third Party] changes this methodology, the Report will not be applicable to any Financial Statement¹ submitted thereafter.

The scope of the Procedures and the definition of the standard statements and findings were determined solely by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence.

Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, we do not give a statement of assurance on the costs declared on the basis of the [Beneficiary's] [Linked Third Party's] Methodology. Had we carried out additional procedures or had we performed an audit or review in accordance with these standards, other matters might have come to its attention and would have been included in the Report.

Exceptions

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] agreed with the standard Statements and provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and corroborate the standard Findings.

List here any exception and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, also indicate the corresponding amount.

.....

Explanation of possible exceptions in the form of examples (to be removed from the Report):

- i. the [Beneficiary] [Linked Third Party] did not agree with the standard Statement number ... because...;
- ii. the Auditor could not carry out the procedure ... established because (e.g. due to the inability to reconcile key information or the unavailability or inconsistency of data);
- iii. the Auditor could not confirm or corroborate the standard Finding number ... because

Remarks

We would like to add the following remarks relevant for the proper understanding of the Methodology applied by the [Beneficiary] [Linked Third Party] or the results reported:

Example (to be removed from the Report):

Regarding the methodology applied to calculate hourly rates ...

Regarding standard Finding 15 it has to be noted that ...

The [Beneficiary] [Linked Third Party] explained the deviation from the benchmark statement XXIV concerning time recording for personnel with no exclusive dedication to the action in the following manner:

...

Annexes

Please provide the following documents to the auditor and annex them to the report when submitting this CoMUC to the JU:

¹ Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;
2. Brief description of the time recording system in place;
3. An example of the time records used by the [Beneficiary] [Linked Third Party];
4. Description of any budgeted or estimated elements applied, together with an explanation as to why they are relevant for calculating the personnel costs and how they are based on objective and verifiable information;
5. A summary sheet with the hourly rate for direct personnel declared by the [Beneficiary] [Linked Third Party] and recalculated by the Auditor for each staff member included in the sample (the names do not need to be reported);
6. A comparative table summarising for each person selected in the sample a) the time claimed by the [Beneficiary] [Linked Third Party] in the Financial Statement(s) and b) the time according to the time record verified by the Auditor;
7. A copy of the letter of representation provided to the Auditor.

Use of this Report

This Report has been drawn up solely for the purpose given under Point 1.1 Reasons for the engagement.

The Report:

- is confidential and is intended to be submitted to the JU by the [Beneficiary] [Linked Third Party] in connection with Article 18.1.2 of the Agreement;
- may not be used by the [Beneficiary] [Linked Third Party], by the JU or by the Commission for any other purpose, nor distributed to any other parties;
- may be disclosed by the JU or by the Commission only to authorised parties, in particular the European Anti-Fraud Office (OLAF) and the European Court of Auditors.
- relates only to the usual cost accounting practices specified above and does not constitute a report on the Financial Statements of the [Beneficiary] [Linked Third Party].

No conflict of interest² exists between the Auditor and the Beneficiary [and the Linked Third Party] that could have a bearing on the Report. The total fee paid to the Auditor for producing the Report was EUR [] (including EUR [] of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance which may be required.

Yours sincerely

[legal name of the Auditor]

[name and title of the authorised representative]

[dd Month yyyy]

Signature of the Auditor

² A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Statements to be made by the Beneficiary/Linked Third Party ('the Statements') and Procedures to be carried out by the Auditor ('the Procedures') and standard factual findings ('the Findings') to be confirmed by the Auditor

The European Commission ('the Commission') reserves the right to provide the auditor with guidance regarding the Statements to be made, the Procedures to be carried out or the Findings to be ascertained and the way in which to present them. The Commission reserves the right to vary the Statements, Procedures or Findings by written notification to the Beneficiary/Linked Third Party to adapt the procedures to changes in the grant agreement(s) or to any other circumstances.

If this methodology certificate relates to the Linked Third Party's usual accounting practices for calculating and claiming direct personnel costs declared as unit costs any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
A. Use of the Methodology I. The cost accounting practice described below has been in use since [dd Month yyyy]. II. The next planned alteration to the methodology used by the Beneficiary will be from [dd Month yyyy].	Procedure: ✓ The Auditor checked these dates against the documentation the Beneficiary has provided. Factual finding: 1. The dates provided by the Beneficiary were consistent with the documentation.
B. Description of the Methodology III. The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures. <i>[Please describe the methodology your entity uses to calculate <u>personnel</u> costs, productive hours and hourly rates, present your description to the Auditor and annex it to this certificate]</i> <i>[If the statement of section "B. Description of the methodology" cannot be endorsed by the Beneficiary or there is no written methodology to calculate unit costs it should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings: - ...]</i>	Procedure: ✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology. Factual finding: 2. The brief description was consistent with the relevant manuals, internal guidance and/or other documentary evidence the Auditor has reviewed. 3. The methodology was generally applied by the Beneficiary as part of its usual costs accounting practices.
C. Personnel costs	Procedure:

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<u>General</u>	
IV. The unit costs (hourly rates) are limited to salaries including during parental leave, social security contributions, taxes and other costs included in the remuneration required under national law and the employment contract or equivalent appointing act;	<p><i>The Auditor draws a sample of employees to carry out the procedures indicated in this section C and the following sections D to F.</i> <i>[The Auditor has drawn a random sample of 10 employees assigned to Horizon 2020 action(s). If fewer than 10 employees are assigned to the Horizon 2020 action(s), the Auditor has selected all employees assigned to the Horizon 2020 action(s), complemented by other employees irrespective of their assignments until he has reached 10 employees.].</i> For this sample:</p> <ul style="list-style-type: none"> ✓ the Auditor reviewed all documents relating to personnel costs such as employment contracts, payslips, payroll policy (e.g. salary policy, overtime policy, variable pay policy), accounting and payroll records, applicable national tax, labour and social security law and any other documents corroborating the personnel costs claimed; ✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that: <ul style="list-style-type: none"> i. they were employed directly by the Beneficiary in accordance with applicable national legislation; ii. they were working under the sole technical supervision and responsibility of the latter; iii. they were remunerated in accordance with the Beneficiary's usual practices; iv. they were allocated to the correct group/category/cost centre for the purposes of calculating the unit cost in line with the Beneficiary's usual cost accounting practices; ✓ the Auditor verified that any ineligible items or any costs claimed under other costs categories or costs covered by other types of grant or by other grants financed from the European Union budget have not been taken into account when calculating the personnel costs; ✓ the Auditor numerically reconciled the total amount of personnel costs used to calculate the unit cost with the total amount of personnel costs recorded in the statutory accounts and the payroll system. ✓ to the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, the Auditor carefully examined those elements and checked the information source to confirm that they correspond to objective and verifiable information;
V. Employees are hired directly by the Beneficiary in accordance with national law, and work under its sole supervision and responsibility;	
VI. The Beneficiary remunerates its employees in accordance with its usual practices. This means that personnel costs are charged in line with the Beneficiary's usual payroll policy (e.g. salary policy, overtime policy, variable pay) and no special conditions exist for employees assigned to tasks relating to the European Union or Euratom, unless explicitly provided for in the grant agreement(s);	
VII. The Beneficiary allocates its employees to the relevant group/category/cost centre for the purpose of the unit cost calculation in line with the usual cost accounting practice;	
VIII. Personnel costs are based on the payroll system and accounting system.	
IX. Any exceptional adjustments of actual personnel costs resulted from relevant budgeted or estimated elements and were based on objective and verifiable information. <i>[Please describe the 'budgeted or estimated elements' and their relevance to personnel costs, and explain how they were reasonable and based on objective and verifiable information, present your explanation to the Auditor and annex it to this certificate].</i>	
X. Personnel costs claimed do not contain any of the following ineligible costs: costs related to return on capital; debt and debt service charges; provisions for future losses or debts; interest owed; doubtful debts; currency exchange losses; bank costs charged by the Beneficiary's bank for transfers from the JU; excessive or reckless expenditure; deductible VAT or costs incurred during suspension of the implementation of the action.	
XI. Personnel costs were not declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU budget and grants awarded by bodies other than the JU for the purpose of implementing the EU or Euratom budget in the same period, unless the Beneficiary can demonstrate that the operating grant does not cover any costs of the action).	

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p><u>If additional remuneration as referred to in the grant agreement(s) is paid</u></p> <p>XII. The Beneficiary is a non-profit legal entity;</p> <p>XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required;</p> <p>XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding;</p> <p>XV. The additional remuneration included in the personnel costs used to calculate the hourly rates for the grant agreement(s) is capped at EUR 8 000 per full-time equivalent (reduced proportionately if the employee is not assigned exclusively to the action).</p> <p><i>[If certain statement(s) of section "C. Personnel costs" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings:</i> - ...]</p>	<p>✓ if additional remuneration has been claimed, the Auditor verified that the Beneficiary was a non-profit legal entity, that the amount was capped at EUR 8 000 per full-time equivalent and that it was reduced proportionately for employees not assigned exclusively to the action(s).</p> <p>✓ the Auditor recalculated the personnel costs for the employees in the sample.</p> <p>Factual finding:</p> <ol style="list-style-type: none"> All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation. The employees in the sample were employed directly by the Beneficiary in accordance with applicable national law and were working under its sole supervision and responsibility. Their employment contracts were in line with the Beneficiary's usual policy; Personnel costs were duly documented and consisted solely of salaries, social security contributions (pension contributions, health insurance, unemployment fund contributions, etc.), taxes and other statutory costs included in the remuneration (holiday pay, thirteenth month's pay, etc.); The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records; To the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, those elements were relevant for calculating the personnel costs and correspond to objective and verifiable information. The budgeted or estimated elements used are: — (indicate the elements and their values). Personnel costs contained no ineligible elements; Specific conditions for eligibility were fulfilled when additional remuneration was paid: a) the Beneficiary is registered in the grant agreements as a non-profit legal entity; b) it was paid according to objective criteria generally applied regardless of the source of funding used and c) remuneration was capped at EUR 8 000 per full-time equivalent (or up to up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
	exclusively on the action).
<p>D. Productive hours</p> <p>XVI. The number of productive hours per full-time employee applied is <i>[delete as appropriate]</i>:</p> <p>A. 1720 productive hours per year for a person working full-time (corresponding pro-rata for persons not working full time).</p> <p>B. the total number of hours worked in the year by a person for the Beneficiary</p> <p>C. the standard number of annual hours generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the standard annual workable hours.</p> <p><u>If method B is applied</u></p> <p>XVII. The calculation of the total number of hours worked was done as follows: annual workable hours of the person according to the employment contract, applicable labour agreement or national law plus overtime worked minus absences (such as sick leave and special leave).</p> <p>XVIII. 'Annual workable hours' are hours during which the personnel must be working, at the employer's disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.</p> <p>XIX. The contract (applicable collective labour agreement or national working time legislation) do specify the working time enabling to calculate the annual workable hours.</p> <p><u>If method C is applied</u></p> <p>XX. The standard number of productive hours per year is that of a full-time equivalent.</p> <p>XXI. The number of productive hours per year on which the hourly rate is based i) corresponds to the Beneficiary's usual accounting practices; ii) is at least 90% of the standard number of workable (working) hours per year.</p>	<p>Procedure (same sample basis as for Section C: Personnel costs):</p> <ul style="list-style-type: none"> ✓ The Auditor verified that the number of productive hours applied is in accordance with method A, B or C. ✓ The Auditor checked that the number of productive hours per full-time employee is correct. ✓ If method B is applied the Auditor verified i) the manner in which the total number of hours worked was done and ii) that the contract specified the annual workable hours by inspecting all the relevant documents, national legislation, labour agreements and contracts. ✓ If method C is applied the Auditor reviewed the manner in which the standard number of working hours per year has been calculated by inspecting all the relevant documents, national legislation, labour agreements and contracts and verified that the number of productive hours per year used for these calculations was at least 90% of the standard number of working hours per year. <p>Factual finding:</p> <p><u>General</u></p> <p>12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column.</p> <p>13. The number of productive hours per year per full-time employee was accurate.</p> <p><u>If method B is applied</u></p> <p>14. The number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary and the calculation of the total number of hours worked was accurate.</p> <p>15. The contract specified the working time enabling to calculate the annual workable hours.</p> <p><u>If method C is applied</u></p> <p>16. The calculation of the number of productive hours per year corresponded</p>

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>XXII. Standard workable (working) hours are hours during which personnel are at the Beneficiary's disposal performing the duties described in the relevant employment contract, collective labour agreement or national labour legislation. The number of standard annual workable (working) hours that the Beneficiary claims is supported by labour contracts, national legislation and other documentary evidence.</p> <p><i>[If certain statement(s) of section "D. Productive hours" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor: - ...]</i></p>	<p>to the usual costs accounting practice of the Beneficiary.</p> <p>17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary.</p> <p>18. The number of productive hours per year used for the calculation of the hourly rate was at least 90 % of the number of workable (working) hours per year.</p>
<p>E. Hourly rates</p> <p>The hourly rates are correct because:</p> <p>XXIII. Hourly rates are correctly calculated since they result from dividing annual personnel costs by the productive hours of a given year and group (e.g. staff category or department or cost centre depending on the methodology applied) and they are in line with the statements made in section C. and D. above.</p> <p><i>[If the statement of section 'E. Hourly rates' cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor: - ...]</i></p>	<p>Procedure</p> <ul style="list-style-type: none"> ✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used. ✓ The Auditor has obtained a list of all the relevant employees, based on which the personnel rate(s) are calculated. <p>For 10 employees selected at random (same sample basis as Section C: Personnel costs):</p> <ul style="list-style-type: none"> ✓ The Auditor recalculated the hourly rates. ✓ The Auditor verified that the methodology applied corresponds to the usual accounting practices of the organisation and is applied consistently for all activities of the organisation on the basis of objective criteria irrespective of the source of funding. <p>Factual finding:</p> <p>19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.</p>
<p>F. Time recording</p> <p>XXIV. Time recording is in place for all persons with no exclusive dedication to one Horizon 2020 action. At least all hours worked in connection with the grant agreement(s) are registered on a daily/weekly/monthly basis <i>[delete as appropriate]</i> using a paper/computer-based system <i>[delete as appropriate]</i>;</p> <p>XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put</p>	<p>Procedure</p> <ul style="list-style-type: none"> ✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time. <p>The Auditor reviewed the time records of the random sample of 10 employees referred to under Section C: Personnel costs, and verified in particular:</p>

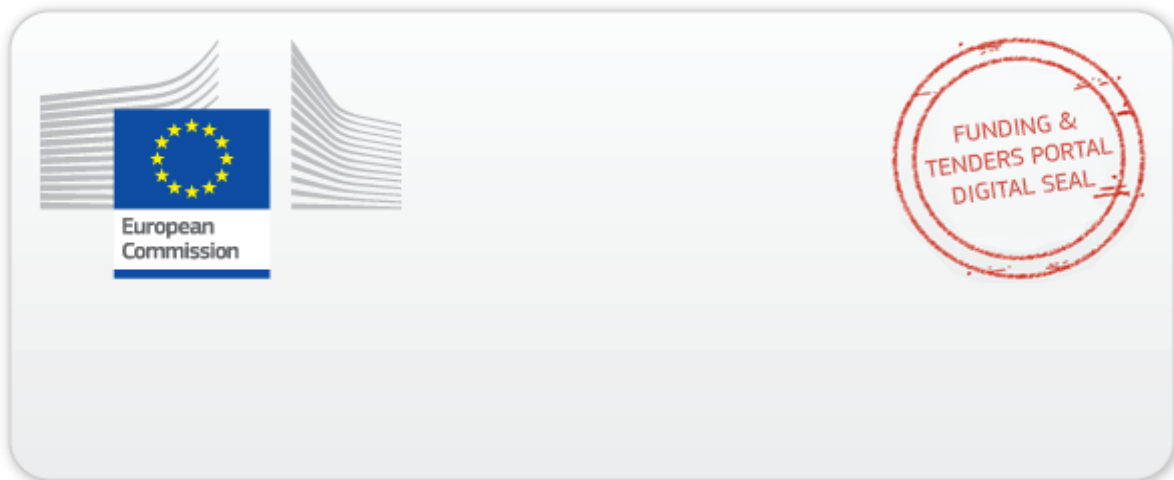
<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>arrangements in place to record their working time;</p> <p>XXVI. Records of time worked have been signed by the person concerned (on paper or electronically) and approved by the action manager or line manager at least monthly;</p> <p>XXVII. Measures are in place to prevent staff from:</p> <ul style="list-style-type: none"> i. recording the same hours twice, ii. recording working hours during absence periods (e.g. holidays, sick leave), iii. recording more than the number of productive hours per year used to calculate the hourly rates, and iv. recording hours worked outside the action period. <p>XXVIII. No working time was recorded outside the action period;</p> <p>XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates.</p> <p><i>[Please provide a brief description of the <u>time recording system</u> in place together with the measures applied to ensure its reliability to the Auditor and annex it to the present certificate¹].</i></p> <p><i>[If certain statement(s) of section “F. Time recording” cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor: - ...]</i></p>	<ul style="list-style-type: none"> ✓ that time records were available for all persons with not exclusive assignment to the action; ✓ that time records were available for persons working exclusively for a Horizon 2020 action, or, alternatively, that a declaration signed by the Beneficiary was available for them certifying that they were working exclusively for a Horizon 2020 action; ✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled; ✓ that the persons worked for the action in the periods claimed; ✓ that no more hours were claimed than the productive hours used to calculate the hourly personnel rates; ✓ that internal controls were in place to prevent that time is recorded twice, during absences for holidays or sick leave; that more hours are claimed per person per year for Horizon 2020 actions than the number of productive hours per year used to calculate the hourly rates; that working time is recorded outside the action period; ✓ the Auditor cross-checked the information with human-resources records to verify consistency and to ensure that the internal controls have been effective. In addition, the Auditor has verified that no more hours were charged to Horizon 2020 actions per person per year than the number of productive hours per year used to calculate the hourly rates, and verified that no time worked outside the action period was charged to the action. <p>Factual finding:</p> <p>20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management</p>

¹ The description of the time recording system must state among others information on the content of the time records, its coverage (full or action time-recording, for all personnel or only for personnel involved in H2020 actions), its degree of detail (whether there is a reference to the particular tasks accomplished), its form, periodicity of the time registration and authorisation (paper or a computer-based system; on a daily, weekly or monthly basis; signed and countersigned by whom), controls applied to prevent double-charging of time or ensure consistency with HR-records such as absences and travels as well as its information flow up to its use for the preparation of the Financial Statements.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
	<p>reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements.</p> <p>21. For the random sample time was recorded or, in the case of employees working exclusively for the action, either a signed declaration or time records were available;</p> <p>22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly.</p> <p>23. Working time claimed for the action occurred in the periods claimed;</p> <p>24. No more hours were claimed than the number productive hours used to calculate the hourly personnel rates;</p> <p>25. There is proof that the Beneficiary has checked that working time has not been claimed twice, that it is consistent with absence records and the number of productive hours per year, and that no working time has been claimed outside the action period.</p> <p>26. Working time claimed is consistent with that on record at the human-resources department.</p>

[official name of the [Beneficiary] [Linked Third Party]]
[name and title of authorised representative]
[dd Month yyyy]
<Signature of the [Beneficiary] [Linked Third Party]>

[official name of the Auditor]
[name and title of authorised representative]
[dd Month yyyy]
<Signature of the Auditor>



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